DCS GUIDE

YAK-52

BY CHUCK

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Special thanks to Paul "Goldwolf" Whittingham for creating the guide icons.

The Yakovlev **Yak-52** (Russian: Яковлев Як-52) is a Soviet primary trainer aircraft which first flew in 1976. It was produced in Romania from 1977 to 1998 by Aerostar, as Iak-52, which gained manufacturing rights under agreement within the former COMECON socialist trade organisation. The Yak-52 was designed as an aerobatic trainer for students in the Soviet DOSAAF training organisation, which trained civilian sport pilots and military pilots. Currently the Yak-52 is used in the Fédération Aéronautique Internationale (FAI) World Aerobatic Yak 52 Competition, a popular powered aircraft single-design World Aerobatic Championship.

A descendant of the single-seat competition aerobatic Yakovlev Yak-50, the all-metal Yak-52 is powered by a 268 kW (360 hp) Vedeneyev M14P nine-cylinder radial engine. Since the aircraft was designed to serve as a military trainer, the development of the aircraft incorporates a number of features to be found on the early postwar fighters: notably the cockpit tandem layout (instrument panel, seat design, cockpit opening system), tail design, tricycle landing gear, inner flaps, controls position, access panels on sides of the fuselage, even the location of the radio antenna and overall dimensions of the airplane.

The Yak-52, like most Soviet military aircraft, was designed to operate in rugged environments with minimal maintenance. The Yak has been used in international aerobatic competition up to the Advanced level. It is stressed to +7 and –5 Gs, rolls (to the right) at 180 degrees/second and is capable of every manoeuvre in the Aresti catalog.

One of its key features, unusual in western aircraft, is its extensive pneumatic system. Engine starting, landing gear, flaps, and wheel brakes are all pneumatically actuated. Spherical storage bottles for air, replenished by an engine driven compressor, are situated behind the rear cockpit and contents displayed on the instrument panels. The operating pressure is between 10 and 50 bars (145 and 725 psi) and an emergency circuit is reserved for lowering the undercarriage if the normal supply is exhausted or the compressor fails. Additionally both main and reserve bottles can be charged from a port on the ground with compressed air, usually from a Scuba type air bottle. The ground steering/braking arrangement with a full castering nosewheel takes some adjustment for flyers accustomed to hydraulics, because the aircraft uses differential braking controlled by rudder pedals and a hand operated lever on the control stick. Unlike other western aircraft, the nose wheel is not connected to the rudder pedals. The tricycle landing gear is retractable, but it remains partially exposed in the retracted position, affording both a useful level of drag in down manoeuvres and a measure of protection should the aircraft be forced to land "wheels up."

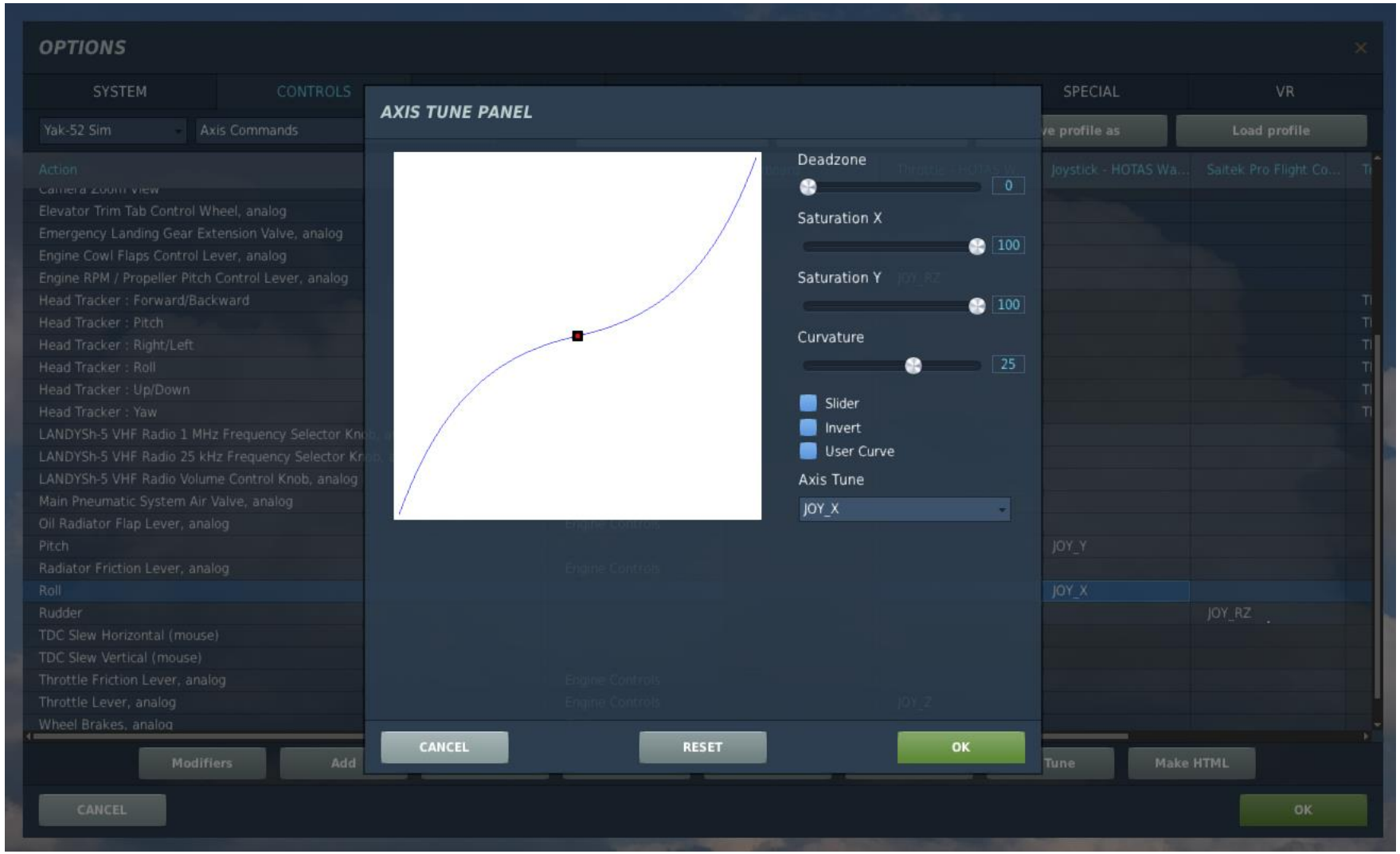
Yak-52 at 2007 Wings over Wairarapa Airshow
Photograph by Dean S. Pemberton

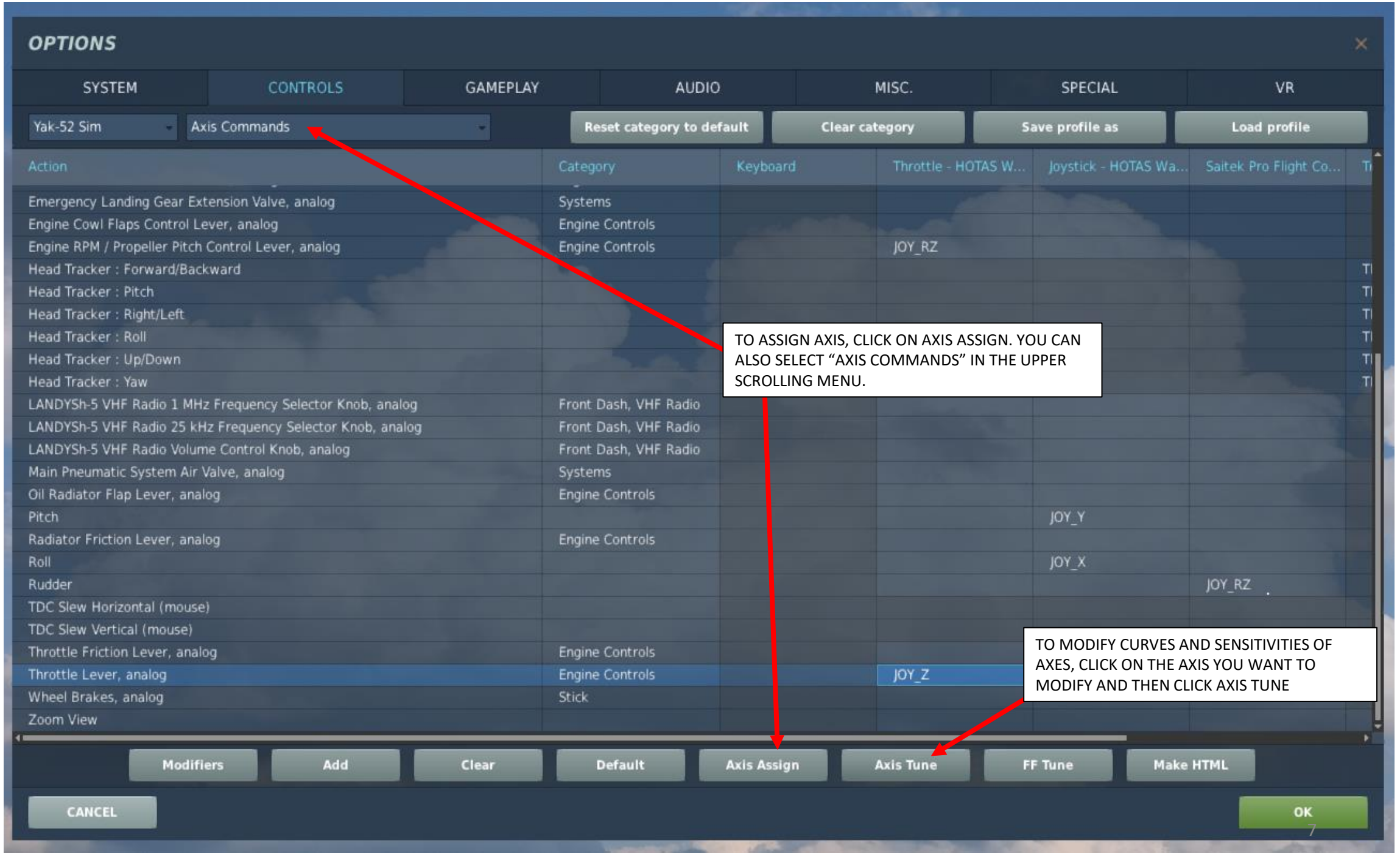
The Yak-52 is the only unarmed aircraft in DCS so far. At first, I wasn't really thrilled by the idea of flying an aircraft that can't pew-pew stuff. However, my opinion of the aircraft changed the very second I had the chance to see one fly in real life. I was lucky enough to see a Yak-52 fly formation with me during one of my training flights. As it tucked itself under my wing, I could hear the raspy roar of the Yak's radial engine. The noise was just deafening! This is one of these old school aerobatic planes that are prized by pilots for their rugged construction and great aerodynamic capabilities. As I flew the Yak more and more, the plane eventually grew on me. It's easy to fly a Yak, but mastering it and pushing it to its limits is what this plane is all about.

CONTROL	FUNCTION
COMM Push-to-Talk (RALT+\)	Used to communicate on the radio
Landing Flaps Lever – DOWN/UP	Used to extend/retract flaps
Elevator Trim Tab Control Wheel – NOSE DOWN/NOSE UP	Elevator Trim control
Landing Gear Lever (Toggle)	Used to extend/retract landing gear
Wheel Brakes	Hold this lever to use pneumatic brakes (both wheels will brake)
Wheel Brake Lock	Used to lock the brake lever into the locked position
Smoke Apparatus - Toggle	Deploys Smoke
Zoom In Slow	Used to zoom in pilot view
Zoom Out Slow	Used to zoom out pilot view

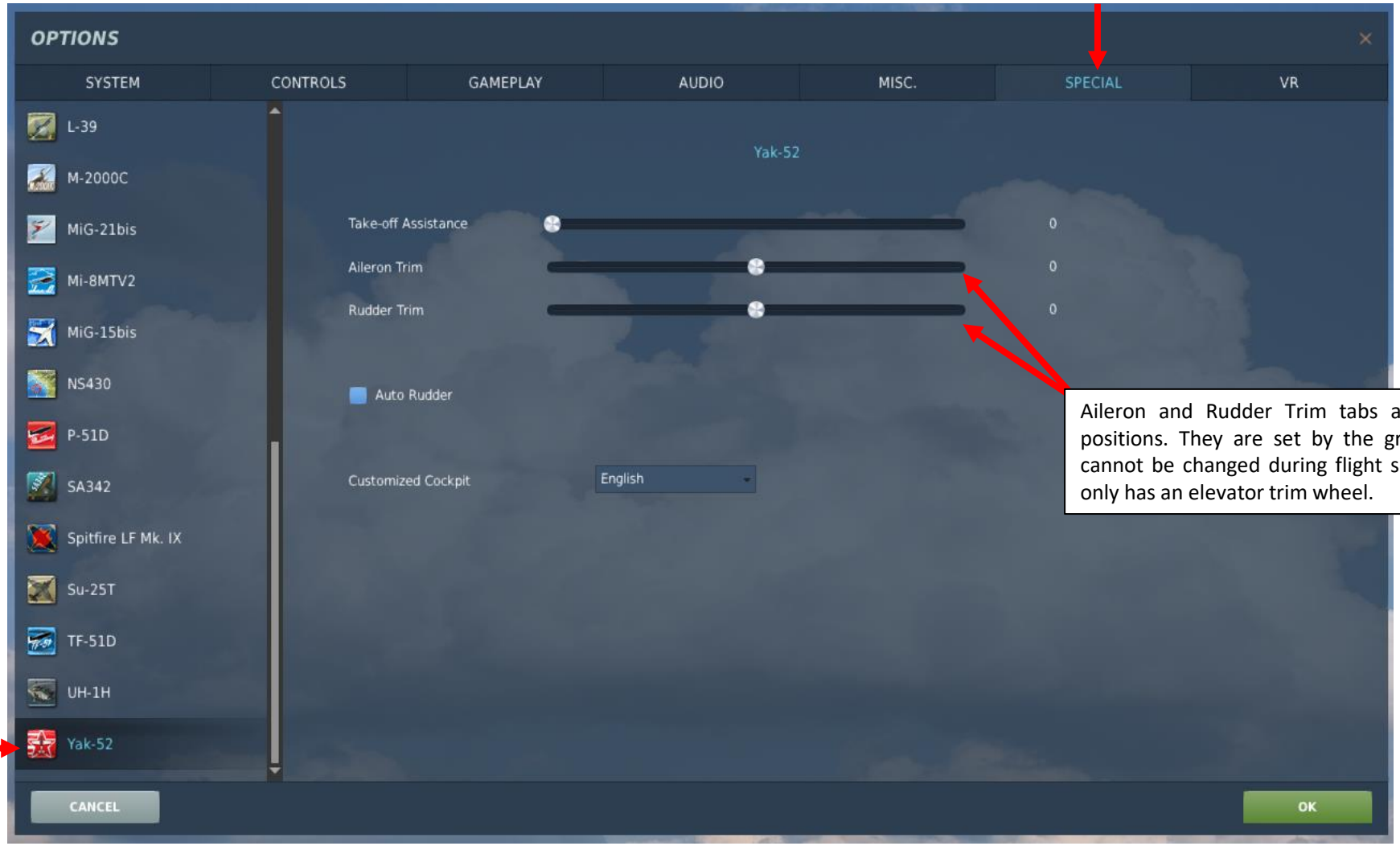
Bind the following axes:

- ENGINE RPM / PROPELLER PITCH CONTROL LEVER (ANALOG) – CONTROLS RPM
- PITCH, ROLL, RUDDER (DEADZONE AT 0, SATURATION X AT 100, SATURATION Y AT 100, CURVATURE AT 25)
- THROTTLE LEVER (ANALOG) – CONTROLS MANIFOLD PRESSURE



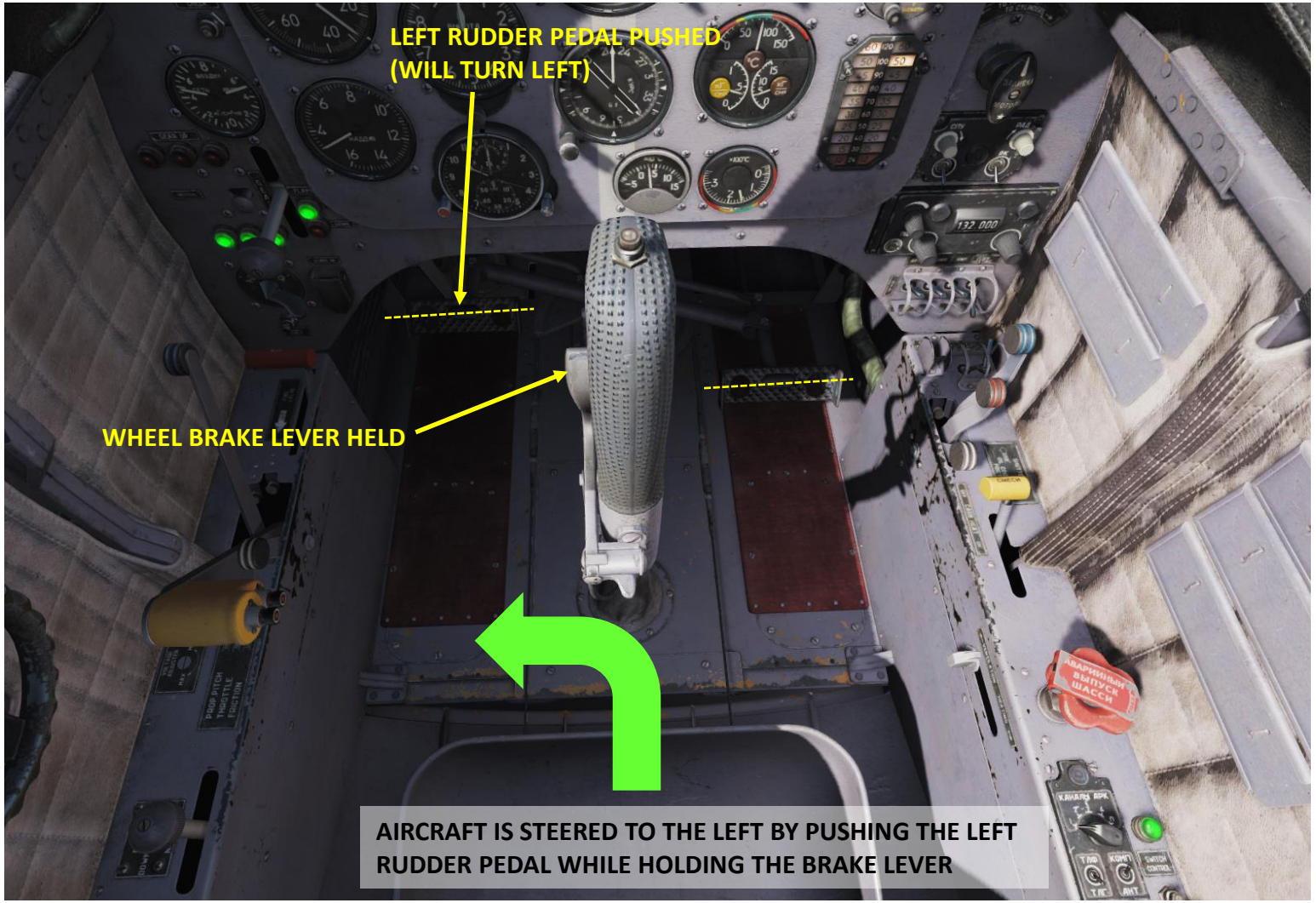

OPTIONS
SYSTEM
CONTROLS
GAMEPLAY
AUDIO
MISC.
SPECIAL
VR
Yak-52 Sim
Axis Commands
Reset category to default
Clear category
Save profile as
Load profile
Action
Category
Keyboard
Throttle - HOTAS W...
Joystick - HOTAS Wa...
Saitek Pro Flight Co...
Emergency Landing Gear Extension Valve, analog
Systems
Engine Cowl Flaps Control Lever, analog
Engine Controls
Engine RPM / Propeller Pitch Control Lever, analog
Engine Controls
JOY_RZ
Head Tracker : Forward/Backward
Head Tracker : Pitch
Head Tracker : Right/Left
Head Tracker : Roll
Head Tracker : Up/Down
Head Tracker : Yaw
LANDYSh-5 VHF Radio 1 MHz Frequency Selector Knob, analog
Front Dash, VHF Radio
LANDYSh-5 VHF Radio 25 kHz Frequency Selector Knob, analog
Front Dash, VHF Radio
LANDYSh-5 VHF Radio Volume Control Knob, analog
Front Dash, VHF Radio
Main Pneumatic System Air Valve, analog
Systems
Oil Radiator Flap Lever, analog
Engine Controls
Pitch
JOY_Y
Radiator Friction Lever, analog
Engine Controls
Roll
JOY_X
Rudder
JOY_RZ
TDC Slew Horizontal (mouse)
TDC Slew Vertical (mouse)
Throttle Friction Lever, analog
Engine Controls
Throttle Lever, analog
Engine Controls
JOY_Z
Wheel Brakes, analog
Stick
Zoom View
TO ASSIGN AXIS, CLICK ON AXIS ASSIGN. YOU CAN ALSO SELECT “AXIS COMMANDS” IN THE UPPER SCROLLING MENU.
TO MODIFY CURVES AND SENSITIVITIES OF AXES, CLICK ON THE AXIS YOU WANT TO MODIFY AND THEN CLICK AXIS TUNE
Modifiers
Add
Clear
Default
Axis Assign
Axis Tune
FF Tune
Make HTML
CANCEL
OK

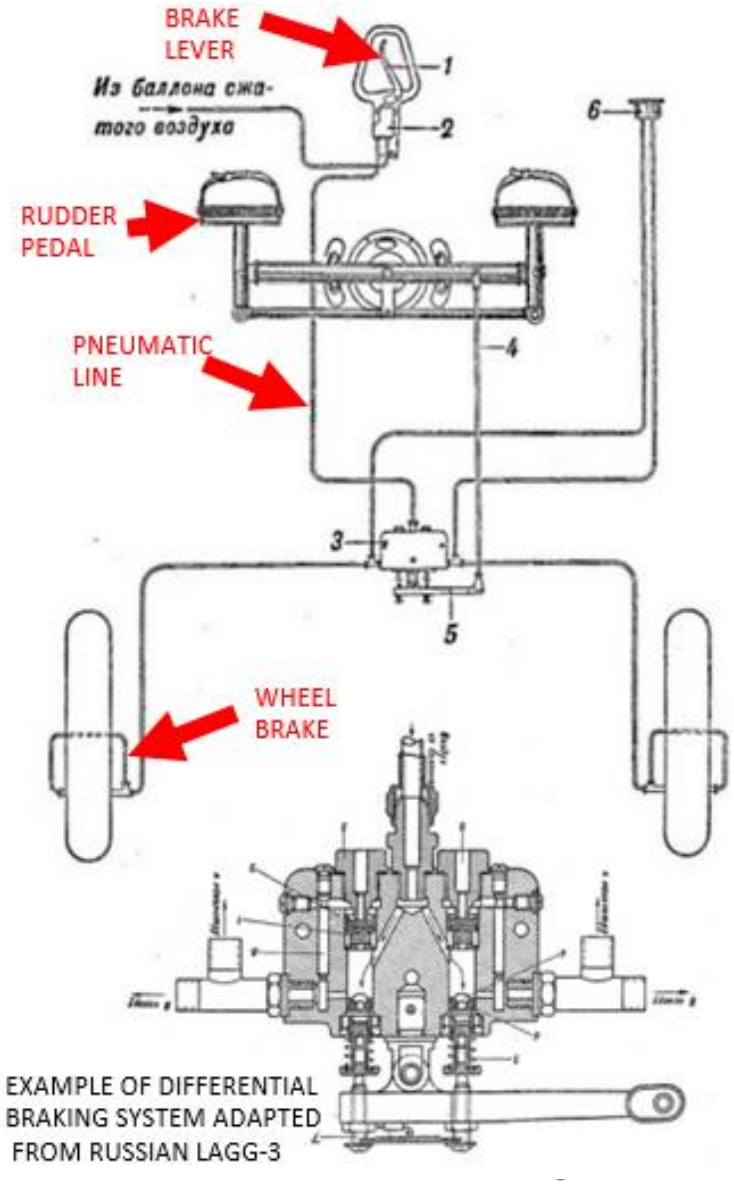
In the “SPECIAL” tab, make sure that Take-Off Assistance is set to 0 and that Auto Rudder is unchecked.



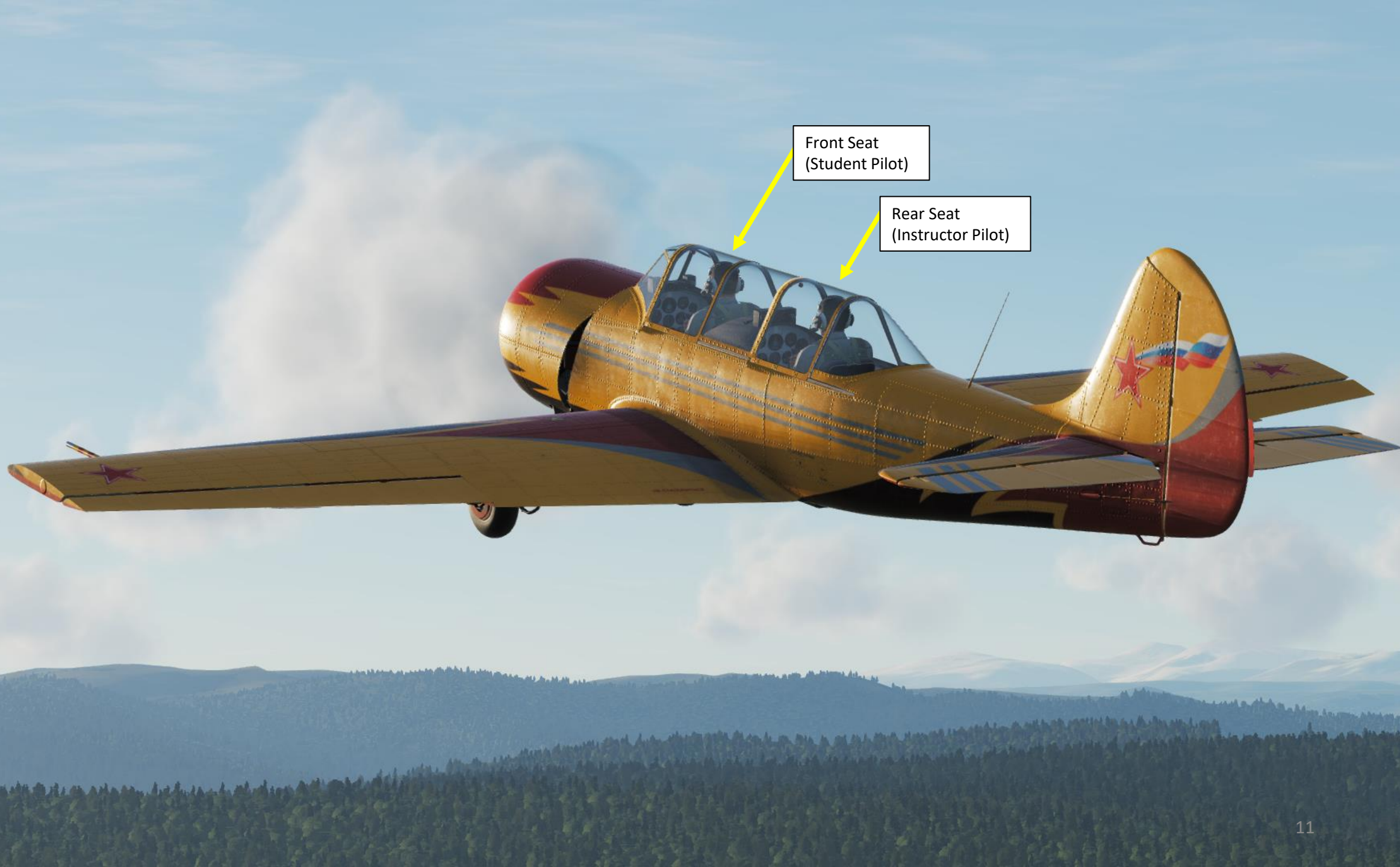
Aileron and Rudder Trim tabs are set to fixed positions. They are set by the ground crew and cannot be changed during flight since the cockpit only has an elevator trim wheel.

Braking is done by holding the braking lever while giving rudder input to steer the aircraft in the direction you want to turn. Make sure you have adequate RPM and Manifold Pressure settings or your turn radius will suffer. The best way to move safely on the tarmac is to give very gentle throttle input to ensure you maintain control of the aircraft while steering left and right once in a while to check for obstacles. It is best to turn while moving and then straighten nose wheel prior to stopping.





EXAMPLE OF DIFFERENTIAL BRAKING SYSTEM ADAPTED FROM RUSSIAN LAGG-3


Front Seat
(Student Pilot)
Rear Seat
(Instructor Pilot)

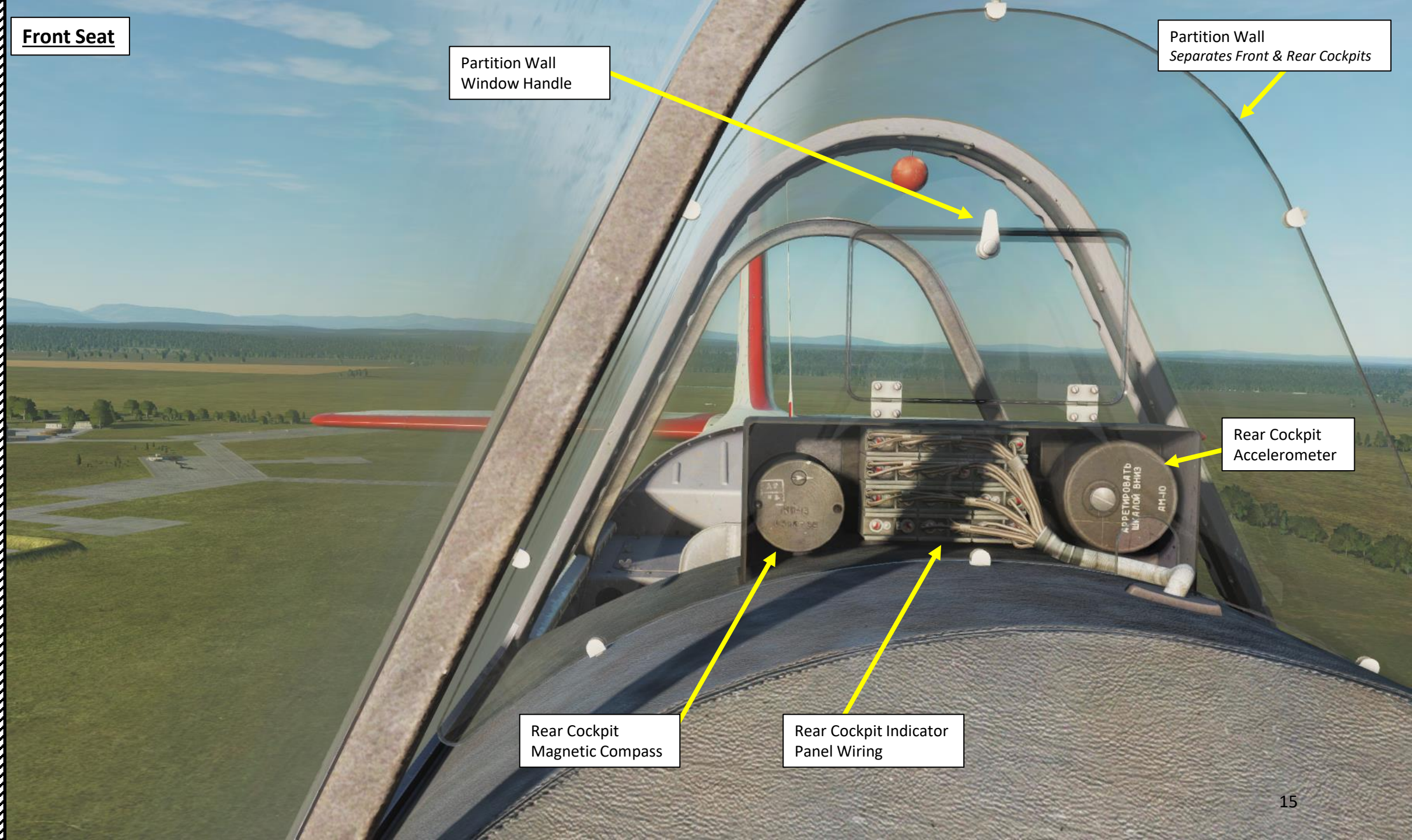
Front Seat

Front Seat

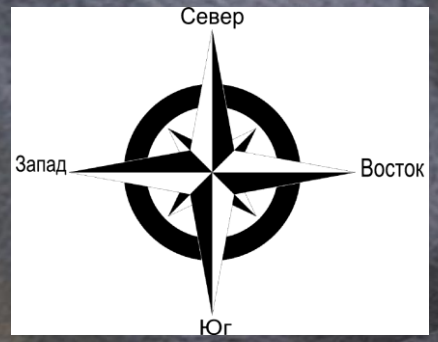
Front Seat

Warning Lights			
STALL (Aircraft stall Warning)	DANGER SPEED (Overturning Speed Warning Light)	METAL CHIPS (metal chip Detected in oil system)	GENER FAULT (Generator Fault, appears when engine RPM is too low for generator to kick in or during an actual generator failure)
MAX G (G Limit Warning)	GYRO WARN (Do not use gyro-compass if illuminated)	STALL HEAT (ON)	PITOT TUBE HEAT (ON)

Front Seat


Partition Wall
Window Handle
Partition Wall
Separates Front & Rear Cockpits
Rear Cockpit
Accelerometer
Rear Cockpit
Magnetic Compass
Rear Cockpit Indicator
Panel Wiring

Front Seat



Radio/Intercom Relay Box

Directional Gyro (GMK-1AE GMC) Hemisphere selector
*N: North (*север*) / S: South (*ЮЖН*)*

Directional Gyro (GMK-1AE GMC) Mode Selector
*MC (*МК*): Magnetic Compass / GC (*ГПК*): Directional Gyro*

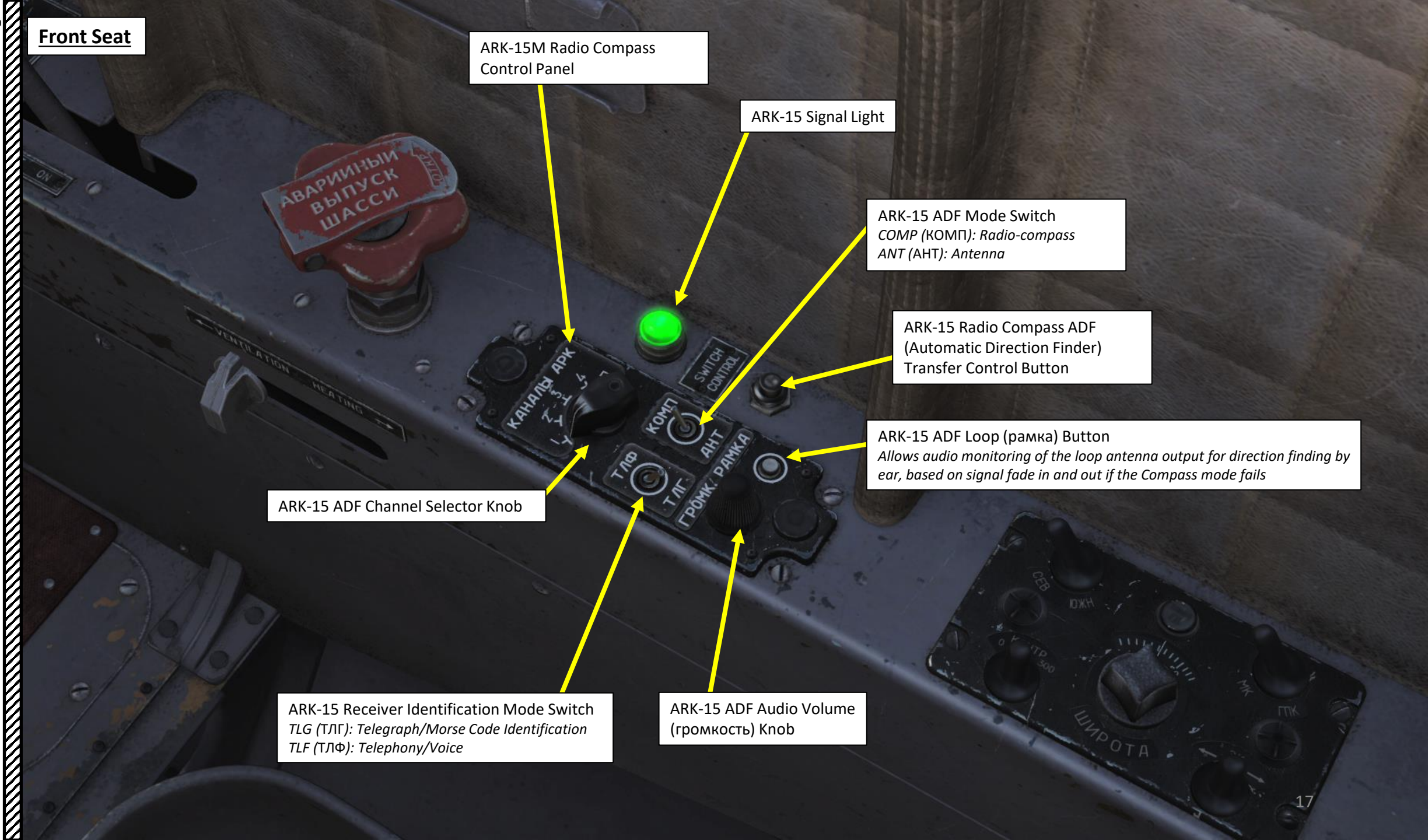
PU-26 Control Panel for GMK-1AE Directional Gyro

Directional Gyro (GMK-1AE GMC) Heading Selector
Counter-Clockwise / OFF / Clockwise

Directional Gyro (GMK-1AE GMC) Latitude (ШИРОТА) Selector Knob

Directional Gyro (GMK-1AE GMC) Test (КОНТРОЛЬ) switch
0 deg / OFF / 300 deg
Used to check heading indication accuracy

Front Seat



ARK-15M Radio Compass Control Panel

ARK-15 Signal Light

ARK-15 ADF Mode Switch
COMP (КОМП): Radio-compass
ANT (АНТ): Antenna

ARK-15 Radio Compass ADF (Automatic Direction Finder) Transfer Control Button

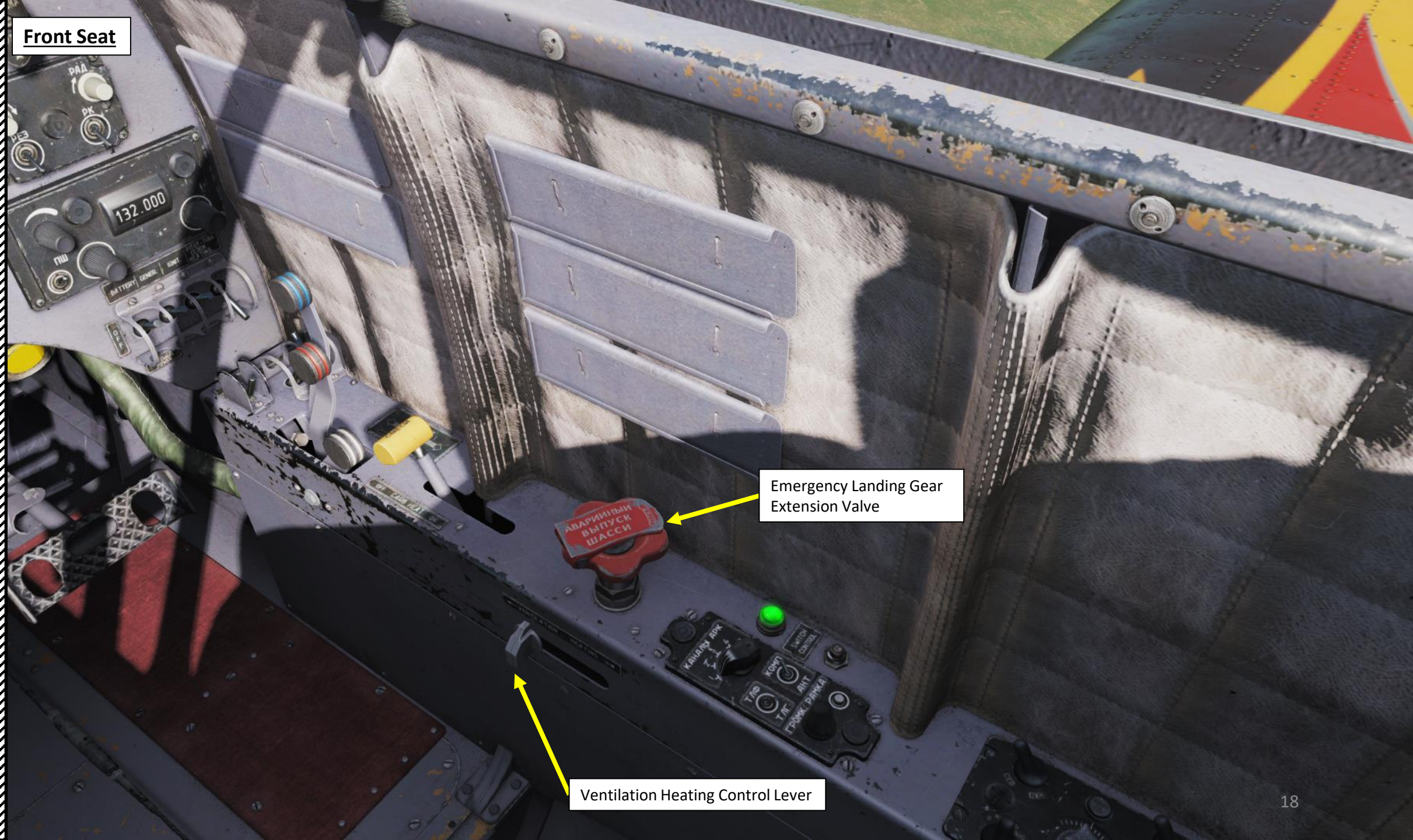
ARK-15 ADF Loop (рамка) Button
Allows audio monitoring of the loop antenna output for direction finding by ear, based on signal fade in and out if the Compass mode fails

ARK-15 ADF Channel Selector Knob

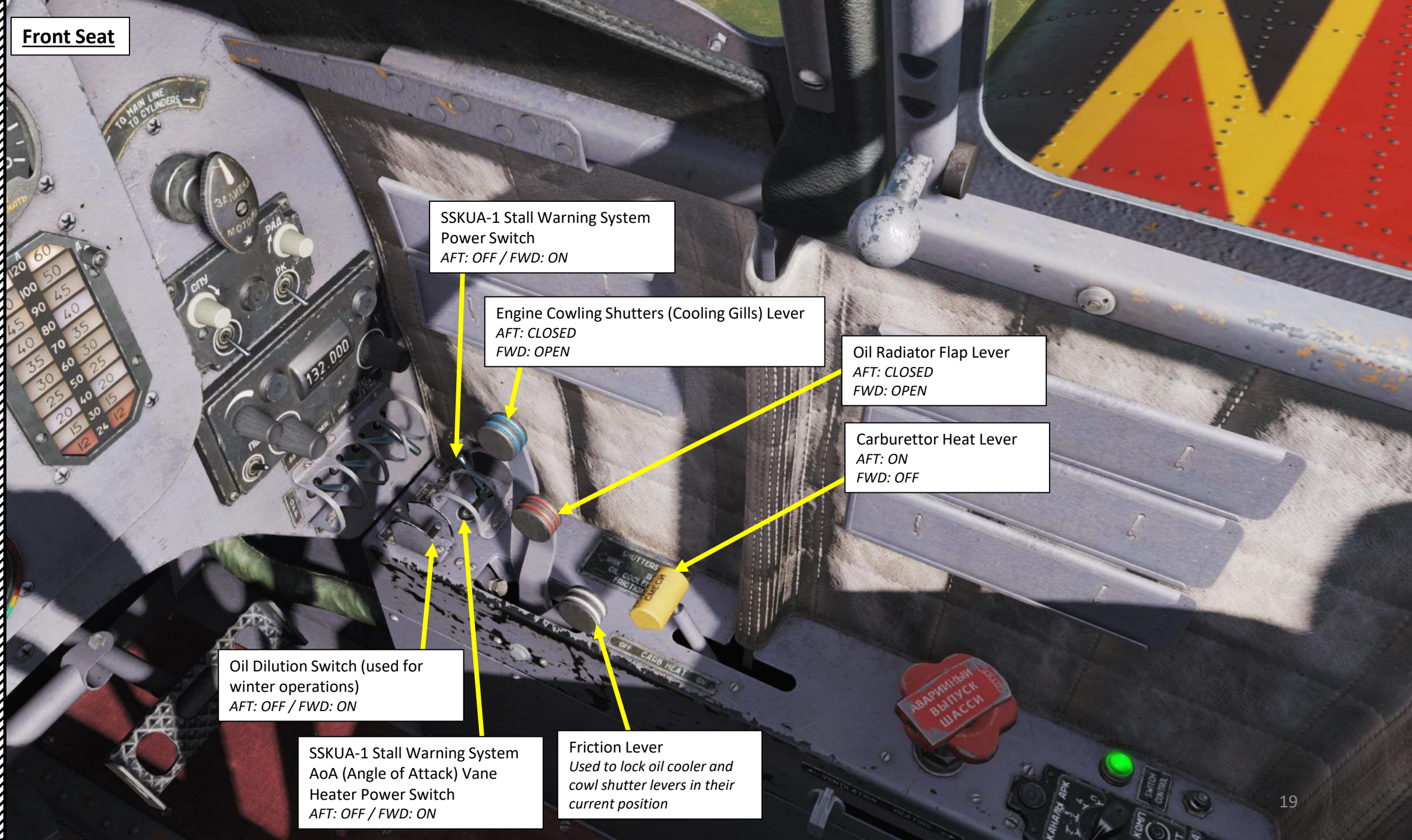
ARK-15 Receiver Identification Mode Switch
TLG (ТЛГ): Telegraph/Morse Code Identification
TLF (ТЛФ): Telephony/Voice

ARK-15 ADF Audio Volume (громкость) Knob

Front Seat


Emergency Landing Gear Extension Valve
Ventilation Heating Control Lever

Front Seat



SSKUA-1 Stall Warning System Power Switch
AFT: OFF / FWD: ON

Engine Cowling Shutters (Cooling Gills) Lever
AFT: CLOSED
FWD: OPEN

Oil Radiator Flap Lever
AFT: CLOSED
FWD: OPEN

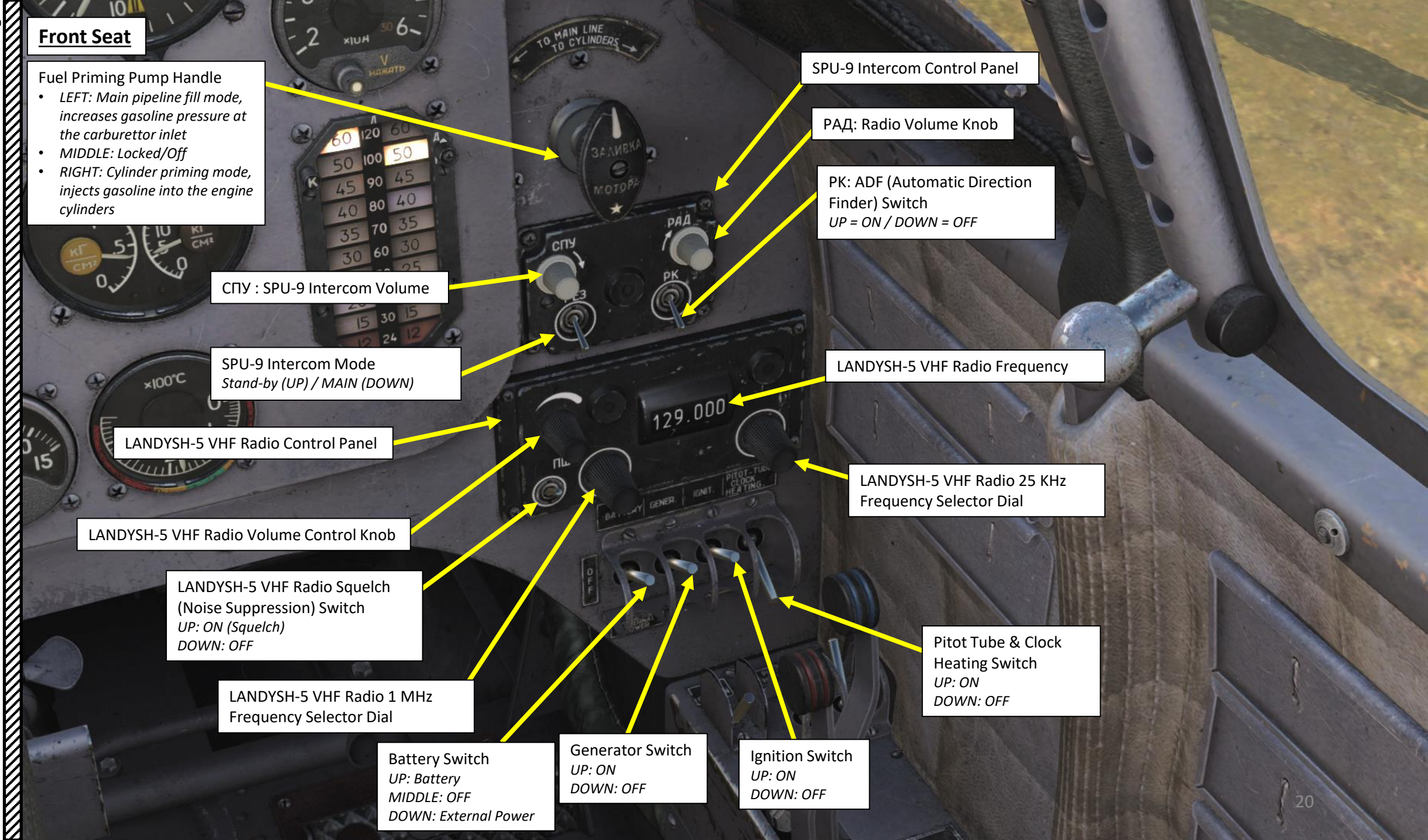
Carburettor Heat Lever
AFT: ON
FWD: OFF

Oil Dilution Switch (used for winter operations)
AFT: OFF / FWD: ON

SSKUA-1 Stall Warning System AoA (Angle of Attack) Vane Heater Power Switch
AFT: OFF / FWD: ON

Friction Lever
Used to lock oil cooler and cowl shutter levers in their current position

Front Seat



Fuel Priming Pump Handle
- *LEFT: Main pipeline fill mode, increases gasoline pressure at the carburettor inlet*
- *MIDDLE: Locked/Off*
- *RIGHT: Cylinder priming mode, injects gasoline into the engine cylinders*

SPU-9 Intercom Control Panel

РАД: Radio Volume Knob

PK: ADF (Automatic Direction Finder) Switch
UP = ON / DOWN = OFF

СПУ : SPU-9 Intercom Volume

SPU-9 Intercom Mode
Stand-by (UP) / MAIN (DOWN)

LANDYSH-5 VHF Radio Frequency

LANDYSH-5 VHF Radio Control Panel

LANDYSH-5 VHF Radio 25 KHz Frequency Selector Dial

LANDYSH-5 VHF Radio Volume Control Knob

LANDYSH-5 VHF Radio Squelch (Noise Suppression) Switch
UP: ON (Squelch)
DOWN: OFF

Pitot Tube & Clock Heating Switch
UP: ON
DOWN: OFF

LANDYSH-5 VHF Radio 1 MHz Frequency Selector Dial

Battery Switch
UP: Battery
MIDDLE: OFF
DOWN: External Power

Generator Switch
UP: ON
DOWN: OFF

Ignition Switch
UP: ON
DOWN: OFF

Front Seat

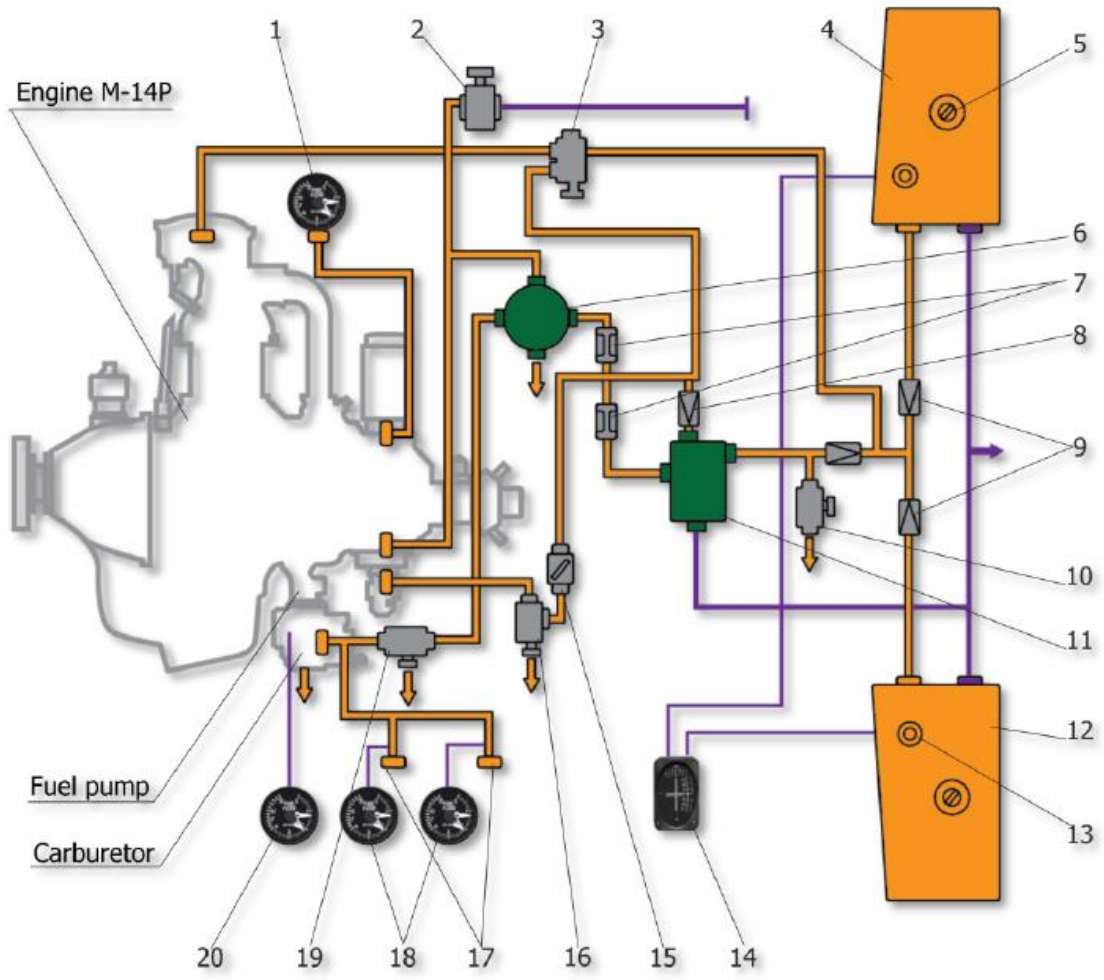


Figure 7. Schematic diagram of the fuel system.

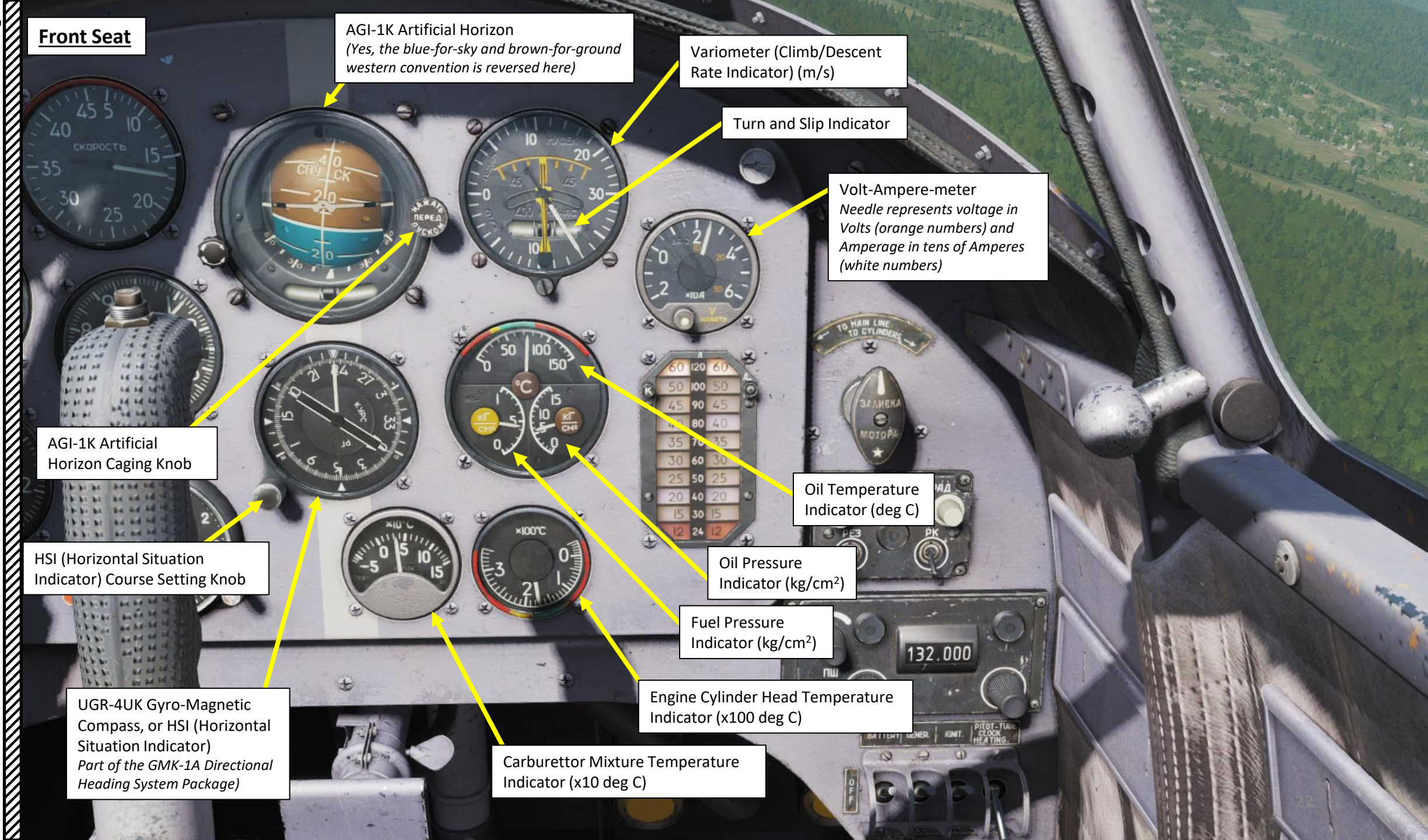
1 - MV16K manovacuummeter; 2 - oil dilution valve; 3 - filler syringe; 4 - right fuel tank; 5 - filler neck; 6 - reserve tank; 7 - throttle valve; 8 - non-return valve; 9 - block of non-return valves; 10 - drain cock; 11 - supply tank; 12 - left fuel tank; 13 - DSU-1-2 fuel gauge sensor; 14 - IUT-3-1 fuel gauge; 15 - fire cock; 16 - gas filter; 17 P-1B fuel pressure receiver; 18 - EMI-3K electric-motor indicators; 19 - fine mesh filter; 20 - TUE-48K mixture temperature indicator.

Left Fuel Tank Indicator (60 litres)

Right Fuel Tank Indicator (60 litres)

Fuel Indicator Test Switch (will display 25 Litres when held)

Fuel Indicator Dimmer Switch (Day/Night)


Front Seat
AGI-1K Artificial Horizon
(Yes, the blue-for-sky and brown-for-ground western convention is reversed here)
Variometer (Climb/Descent Rate Indicator) (m/s)
Turn and Slip Indicator
Volt-Ampere-meter
Needle represents voltage in Volts (orange numbers) and Amperage in tens of Amperes (white numbers)
AGI-1K Artificial Horizon Caging Knob
Oil Temperature Indicator (deg C)
HSI (Horizontal Situation Indicator) Course Setting Knob
Oil Pressure Indicator (kg/cm²)
Fuel Pressure Indicator (kg/cm²)
UGR-4UK Gyro-Magnetic Compass, or HSI (Horizontal Situation Indicator)
Part of the GMK-1A Directional Heading System Package)
Engine Cylinder Head Temperature Indicator (x100 deg C)
Carburettor Mixture Temperature Indicator (x10 deg C)

Front Seat

AGI-1K Artificial Horizon

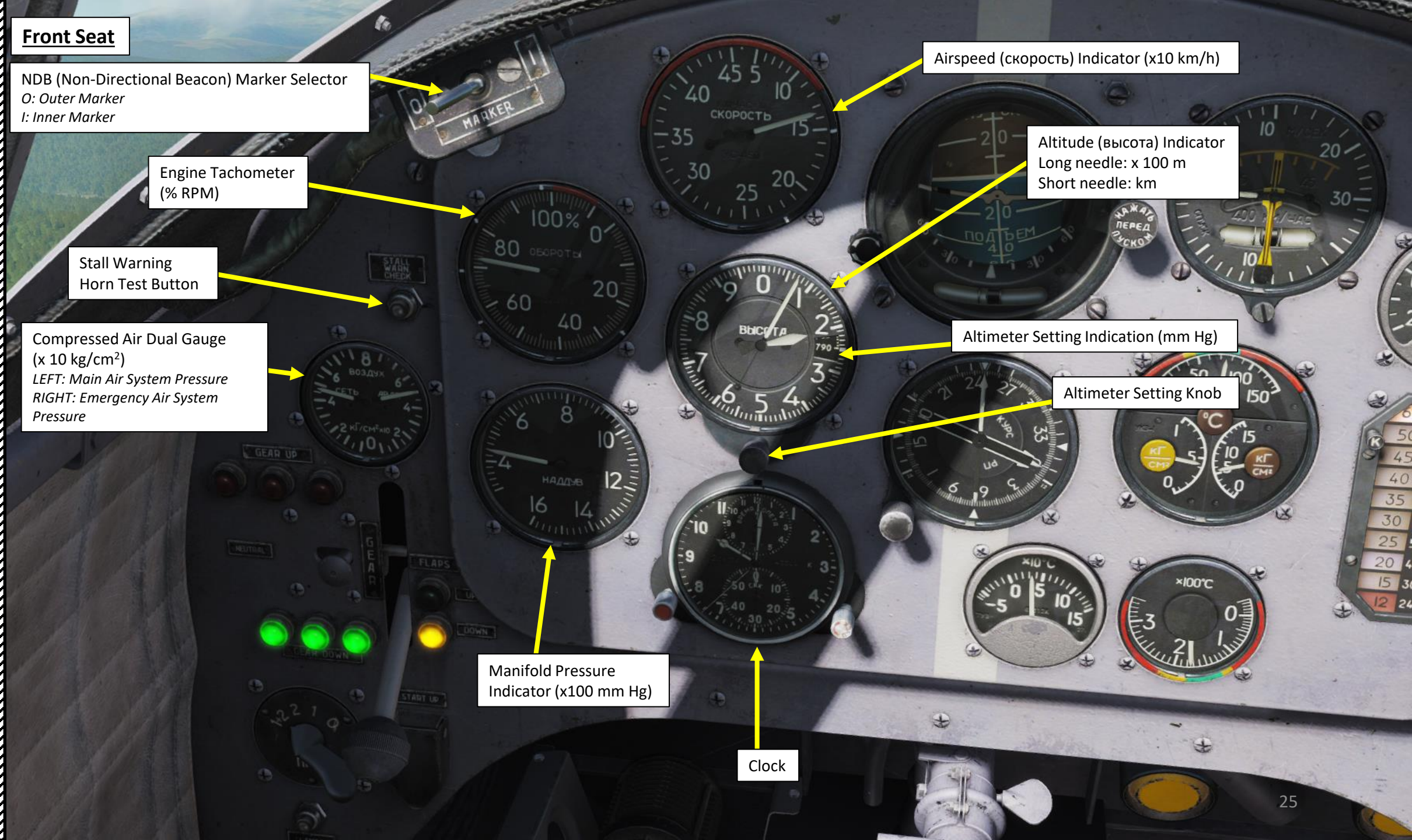
The artificial horizon in the Yak works differently from 'western' ones, mainly in the way the sky and ground are represented.

In the Yak, the gyro keeps the instrument's 'globe' level with the local horizon - whereas 'western' instruments use a system of pivots and levers on the outer gimbal to cause the movement of the gyro to appear in a 'reverse' sense. In the Yak, in level flight, the aircraft symbol is just about on the horizon line. There is brown above and blue below.

If we fly a Pitch Up attitude, the horizon 'globe' remains static, under the influence of its gyro, but the aircraft rotates around the 'globe' in pitch. In a case where the aircraft is pitching up but the globe is still static, you will see there is now MORE blue and LESS brown visible. You are 'looking at' more 'sky', and you can 'see' less 'ground', as you would expect. In a way, this is a simpler system for aerobatic planes like the Yak-52.

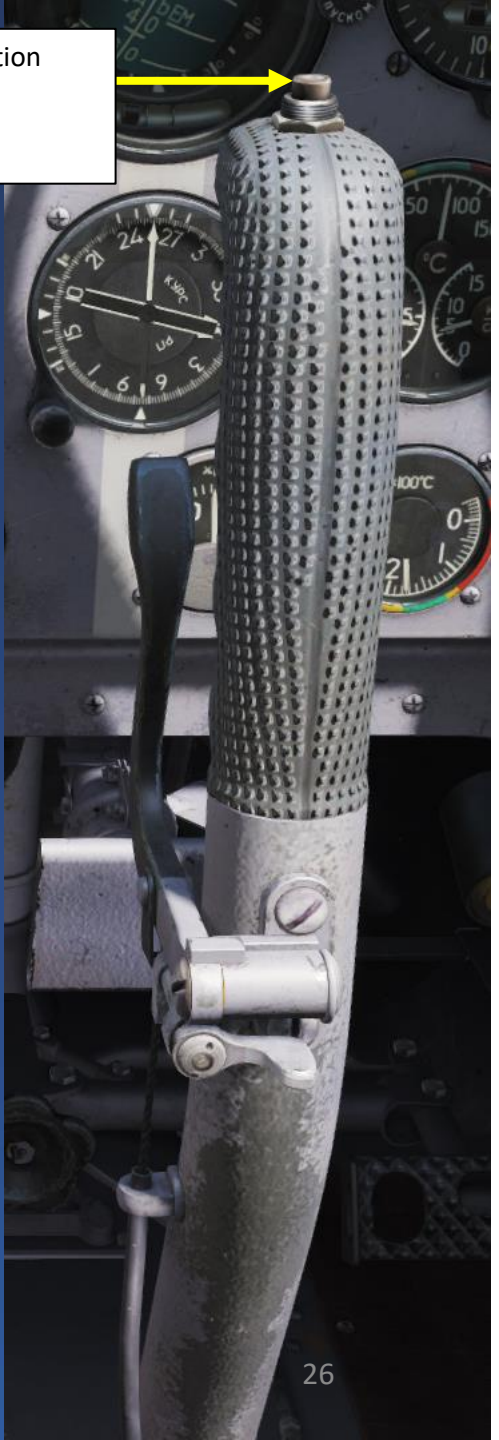
Front Seat


Landing Gear Mechanical Indicator (Shown Deployed)
Accelerometer (G)
Accelerometer Reset Button
Magnetic Compass


Front Seat
NDB (Non-Directional Beacon) Marker Selector
O: Outer Marker
I: Inner Marker
Engine Tachometer
(% RPM)
Stall Warning
Horn Test Button
Compressed Air Dual Gauge
(x 10 kg/cm²)
LEFT: Main Air System Pressure
RIGHT: Emergency Air System
Pressure
Manifold Pressure
Indicator (x100 mm Hg)
Clock
Airspeed (скорость) Indicator (x10 km/h)
Altitude (высота) Indicator
Long needle: x 100 m
Short needle: km
Altimeter Setting Indication (mm Hg)
Altimeter Setting Knob

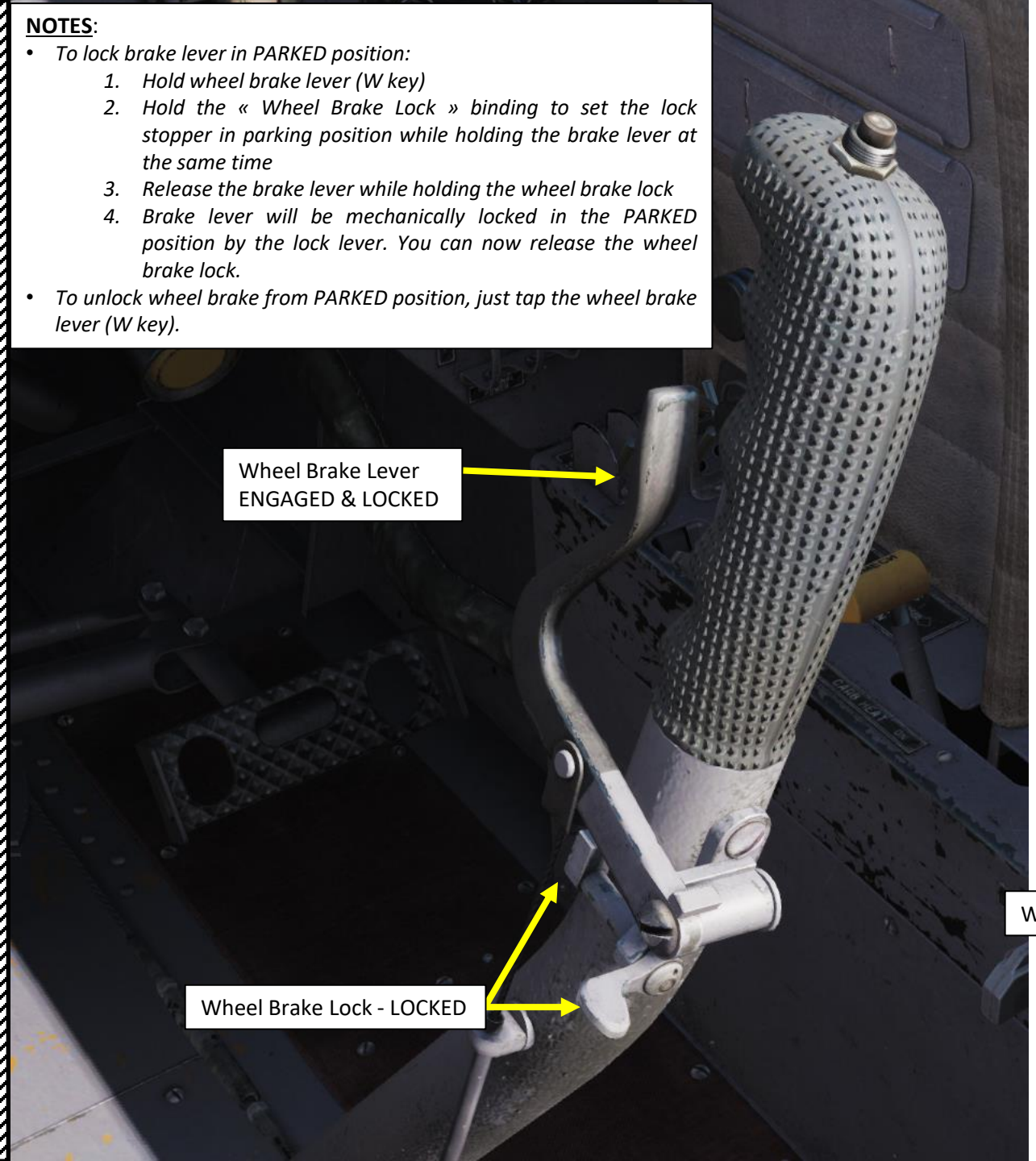
Front Seat

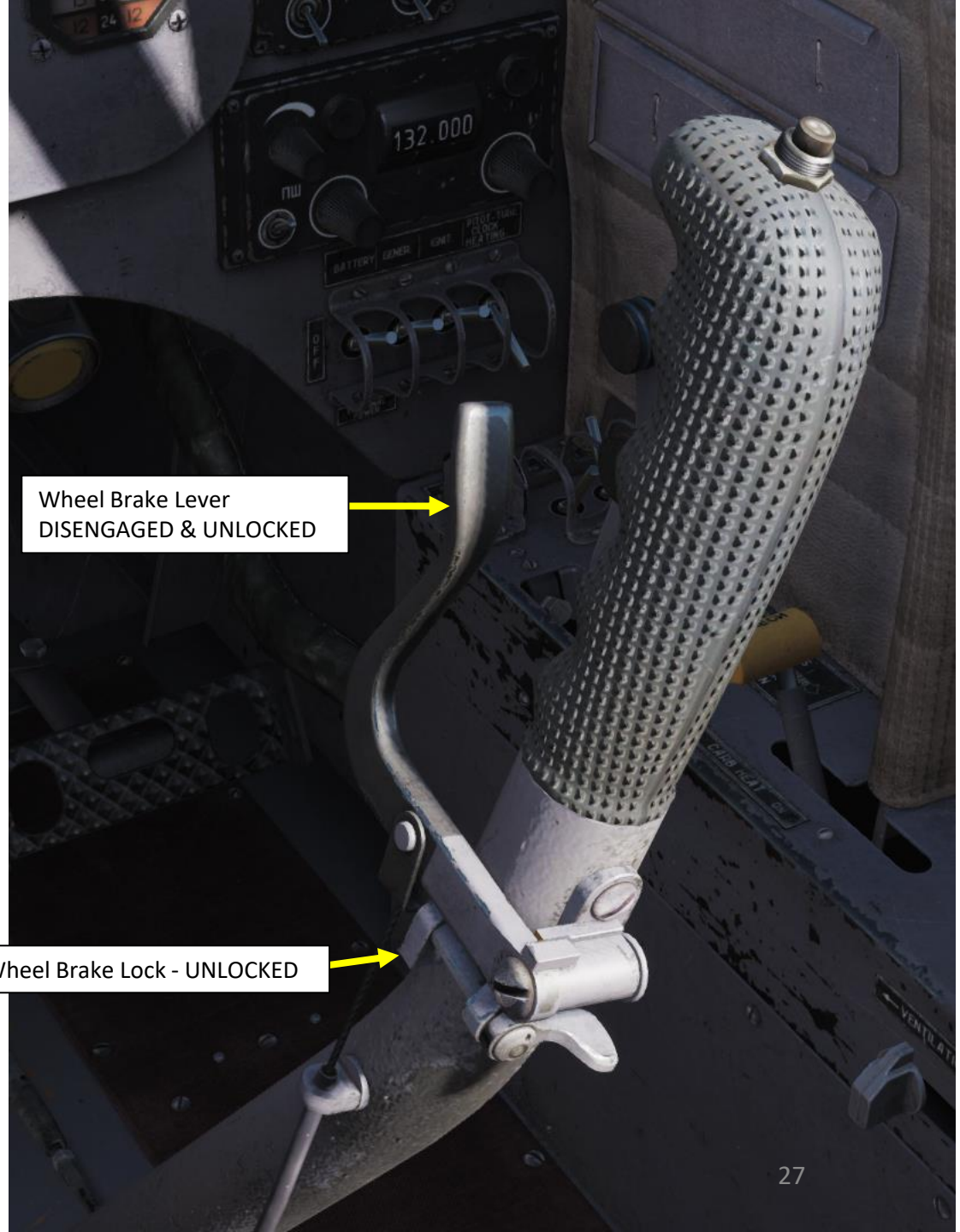
Smoke Generation System Switch
UP: OFF
DOWN: ON



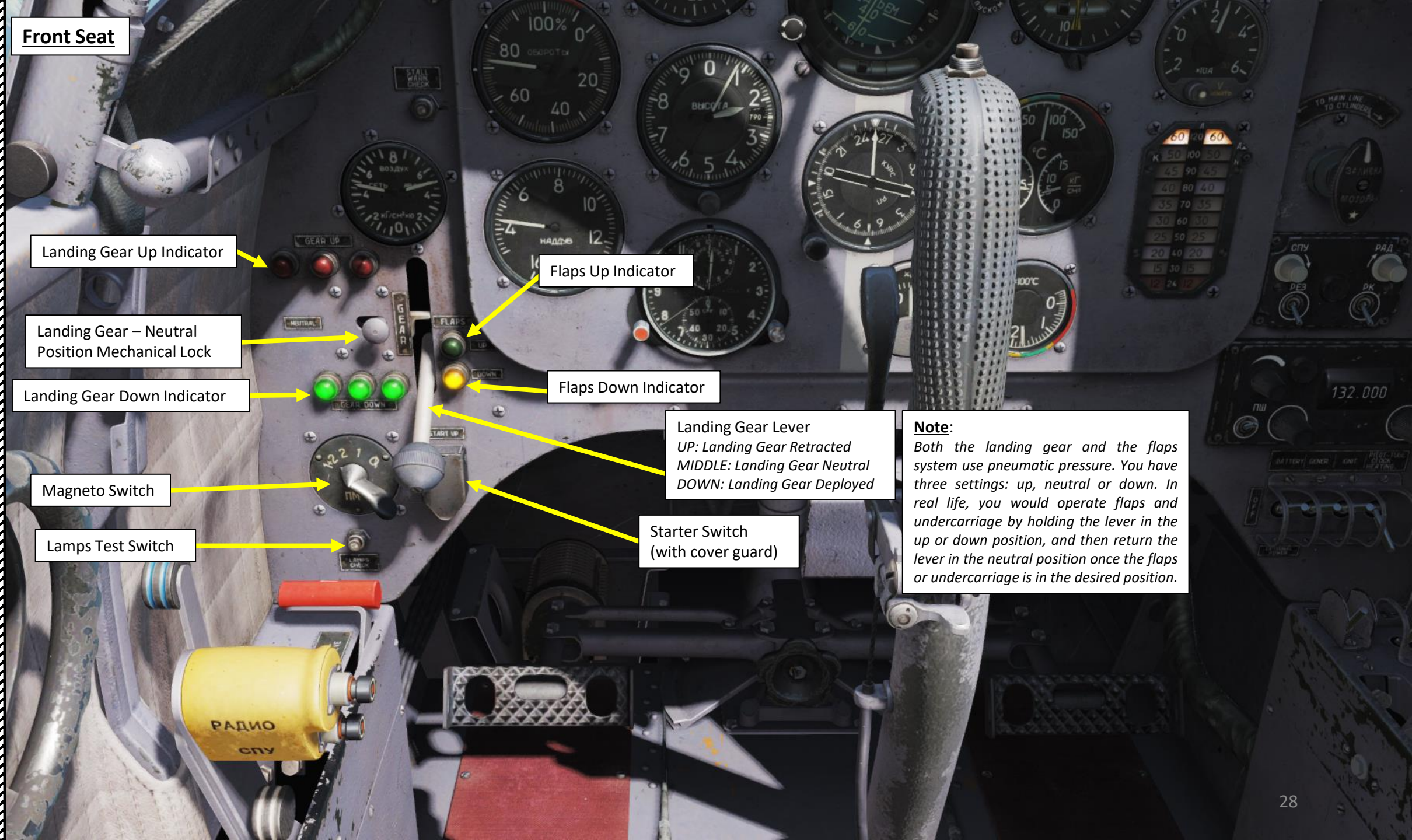
NOTES:

- *To lock brake lever in PARKED position:*
    1. *Hold wheel brake lever (W key)*
    2. *Hold the « Wheel Brake Lock » binding to set the lock stopper in parking position while holding the brake lever at the same time*
    3. *Release the brake lever while holding the wheel brake lock*
    4. *Brake lever will be mechanically locked in the PARKED position by the lock lever. You can now release the wheel brake lock.*
- *To unlock wheel brake from PARKED position, just tap the wheel brake lever (W key).*

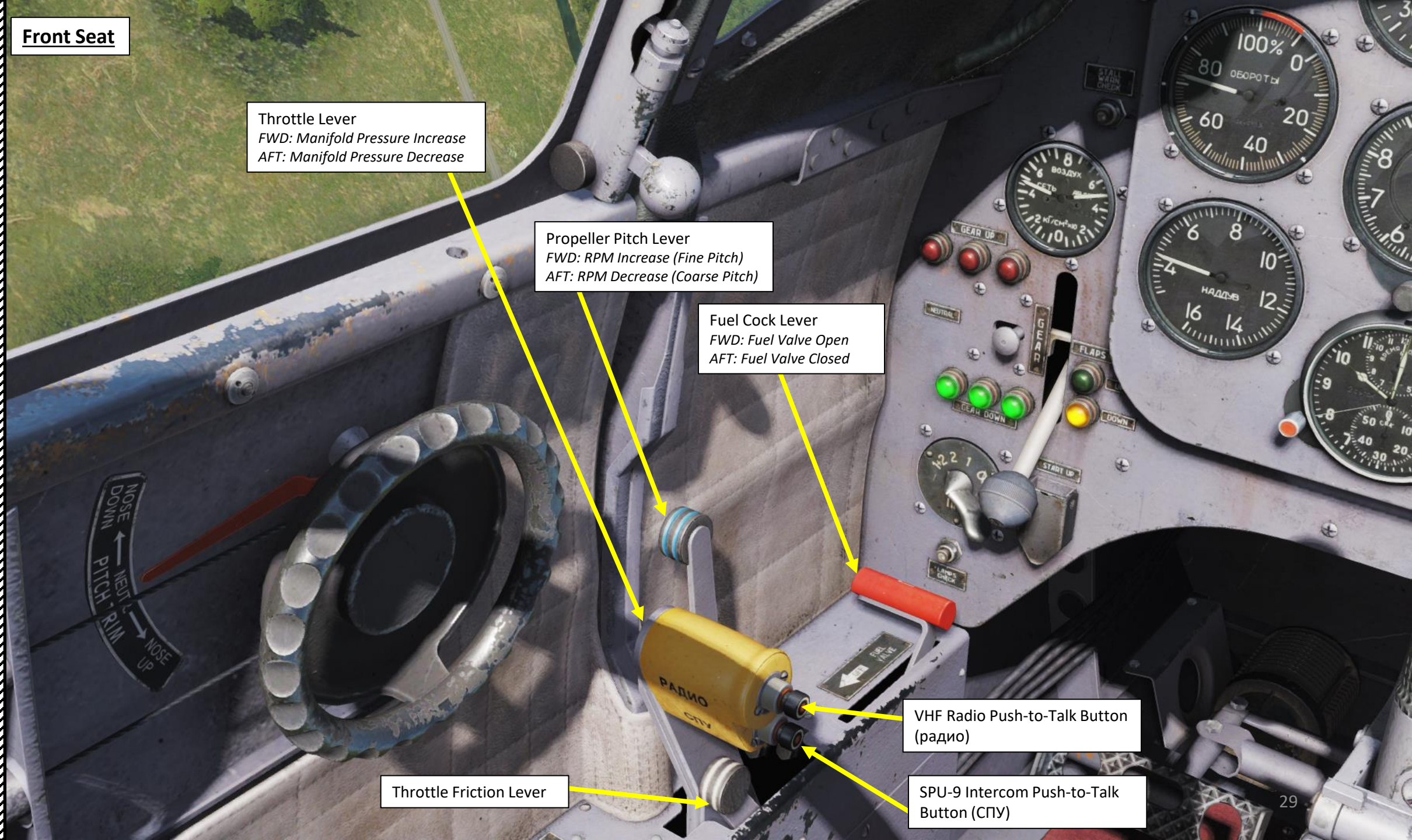


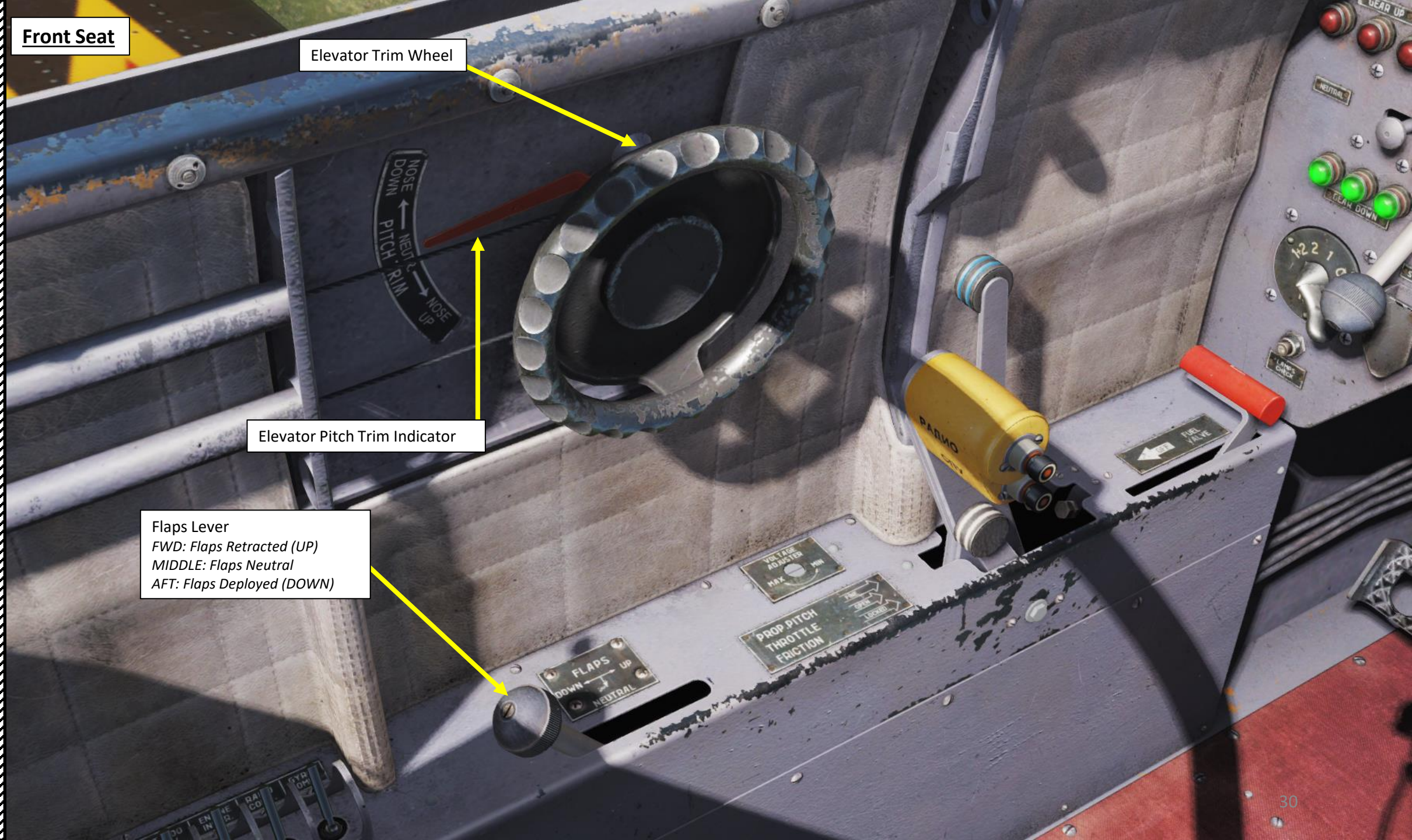


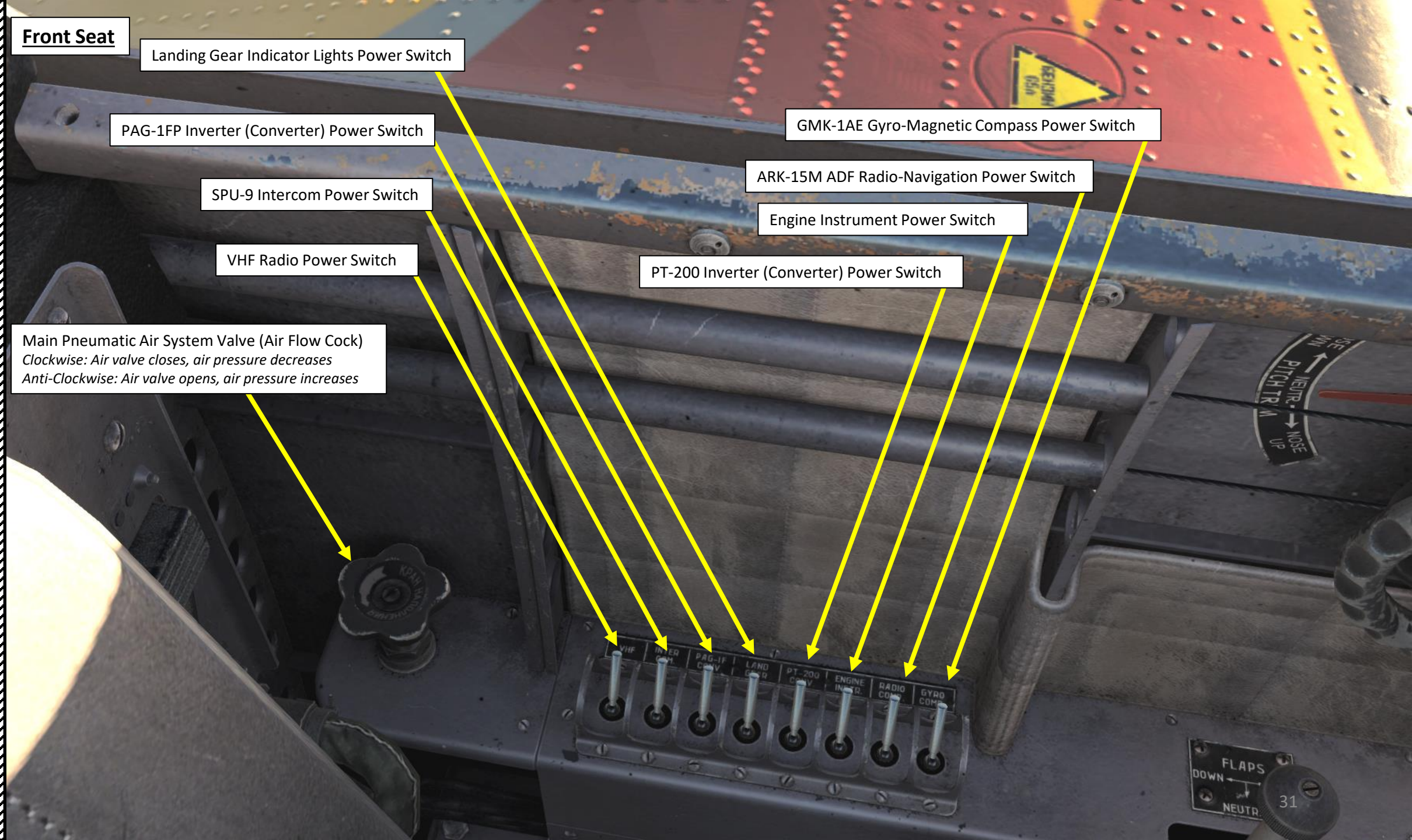
Front Seat


Landing Gear Up Indicator
Flaps Up Indicator
Landing Gear – Neutral Position Mechanical Lock
Landing Gear Down Indicator
Flaps Down Indicator
Landing Gear Lever
UP: Landing Gear Retracted
MIDDLE: Landing Gear Neutral
DOWN: Landing Gear Deployed
Magneto Switch
Starter Switch (with cover guard)
Lamps Test Switch
Note:
Both the landing gear and the flaps system use pneumatic pressure. You have three settings: up, neutral or down. In real life, you would operate flaps and undercarriage by holding the lever in the up or down position, and then return the lever in the neutral position once the flaps or undercarriage is in the desired position.

Front Seat


Throttle Lever
FWD: Manifold Pressure Increase
AFT: Manifold Pressure Decrease
Propeller Pitch Lever
FWD: RPM Increase (Fine Pitch)
AFT: RPM Decrease (Coarse Pitch)
Fuel Cock Lever
FWD: Fuel Valve Open
AFT: Fuel Valve Closed
VHF Radio Push-to-Talk Button (радио)
Throttle Friction Lever
SPU-9 Intercom Push-to-Talk Button (СПУ)
NOSE DOWN
NEUT
NOSE UP
PITCH TRIM
РАДИО
СПУ
GEAR UP
GEAR DOWN
FLAPS
START UP
ОБОРОТЫ
НАДДУВ
ВОЗДУХ


Front Seat
Elevator Trim Wheel
NOSE DOWN
NEUT
NOSE UP
PITCH TRIM
Elevator Pitch Trim Indicator
Flaps Lever
FWD: Flaps Retracted (UP)
MIDDLE: Flaps Neutral
AFT: Flaps Deployed (DOWN)
FLAPS
DOWN
UP
NEUTRAL
PROP PITCH
THROTTLE
FRICTION
VOLTAGE ADJUSTER
MAX
MIN
RADIO
FUEL VALVE
GEAR UP
GEAR DOWN
NEUTRAL

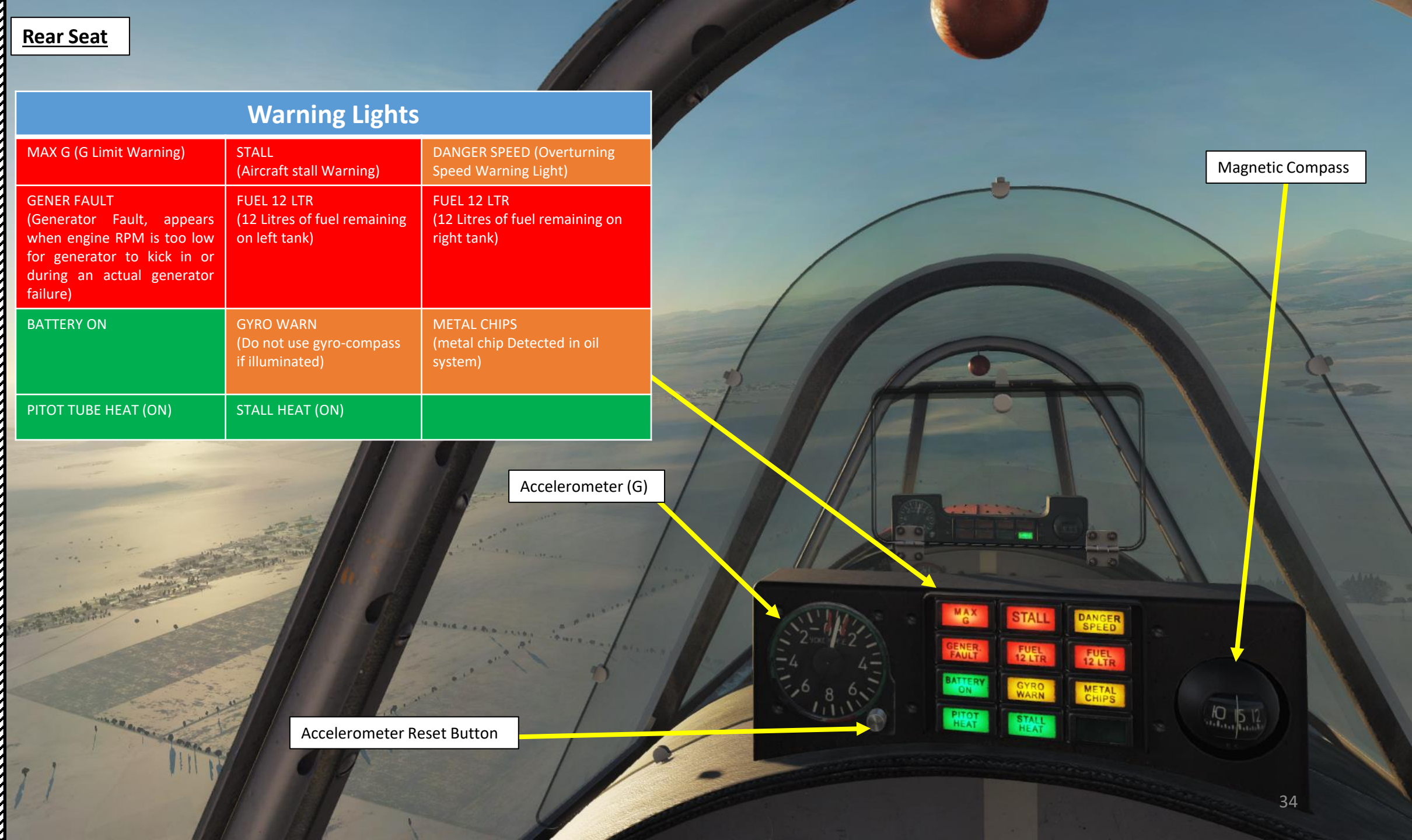

Front Seat
Landing Gear Indicator Lights Power Switch
PAG-1FP Inverter (Converter) Power Switch
SPU-9 Intercom Power Switch
VHF Radio Power Switch
Main Pneumatic Air System Valve (Air Flow Cock)
Clockwise: Air valve closes, air pressure decreases
Anti-Clockwise: Air valve opens, air pressure increases
GMK-1AE Gyro-Magnetic Compass Power Switch
ARK-15M ADF Radio-Navigation Power Switch
Engine Instrument Power Switch
PT-200 Inverter (Converter) Power Switch
PITCH TRIM
NEUTR
NOSE UP
FLAPS
DOWN
NEUTR

Rear Seat

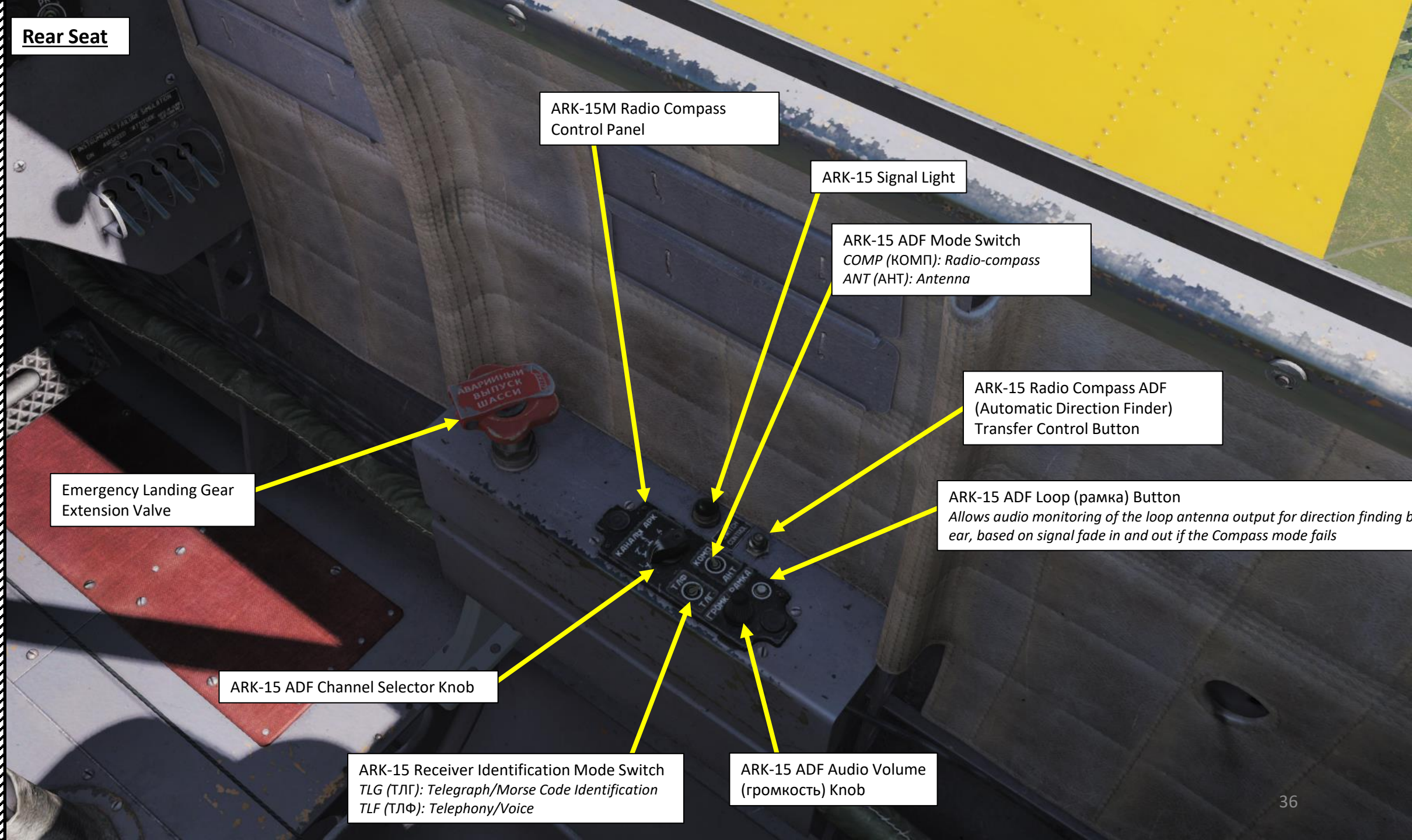

Rear Seat
Canopy Lever
Canopy Lock Lever
Canopy Lock
Canopy Lever

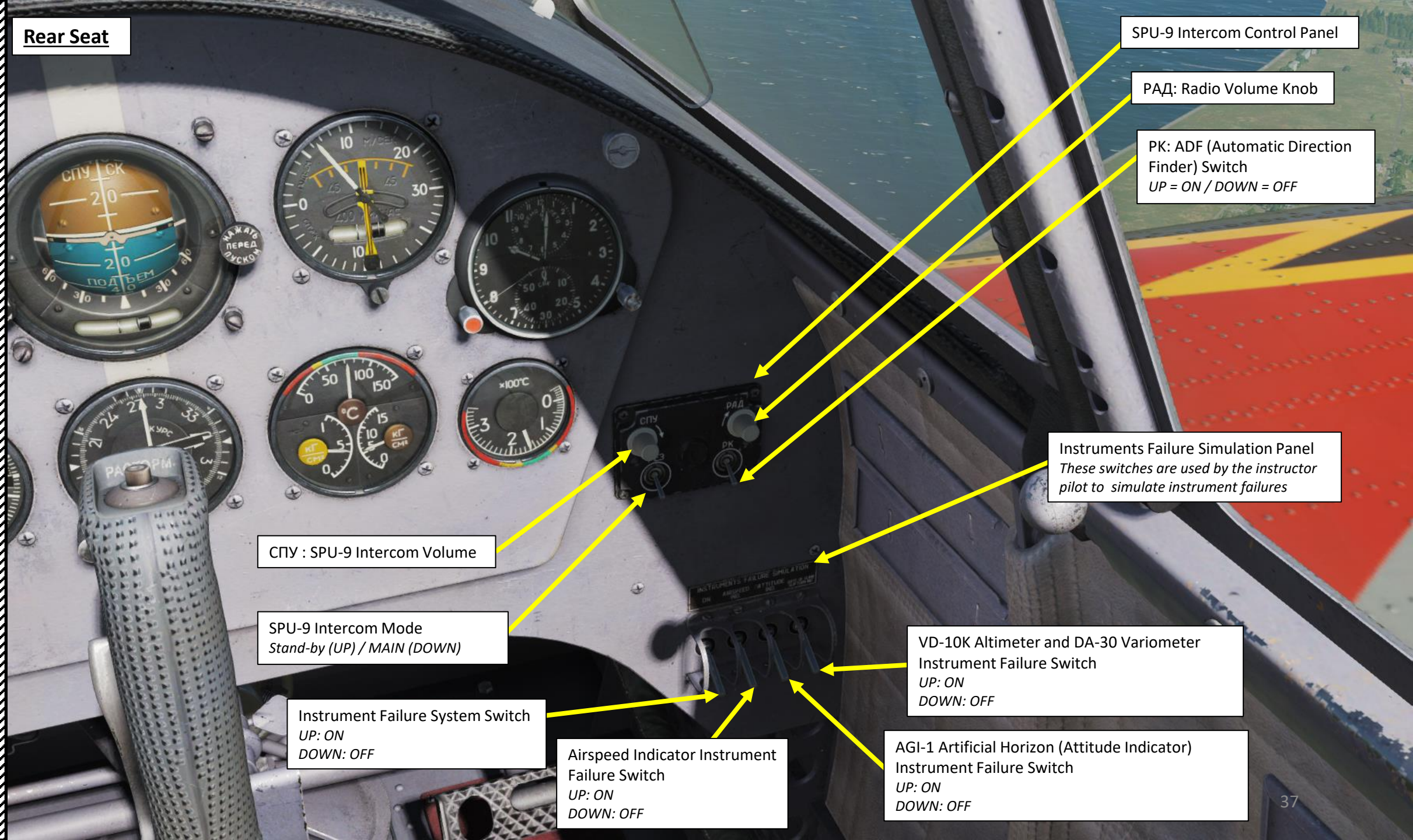
Rear Seat

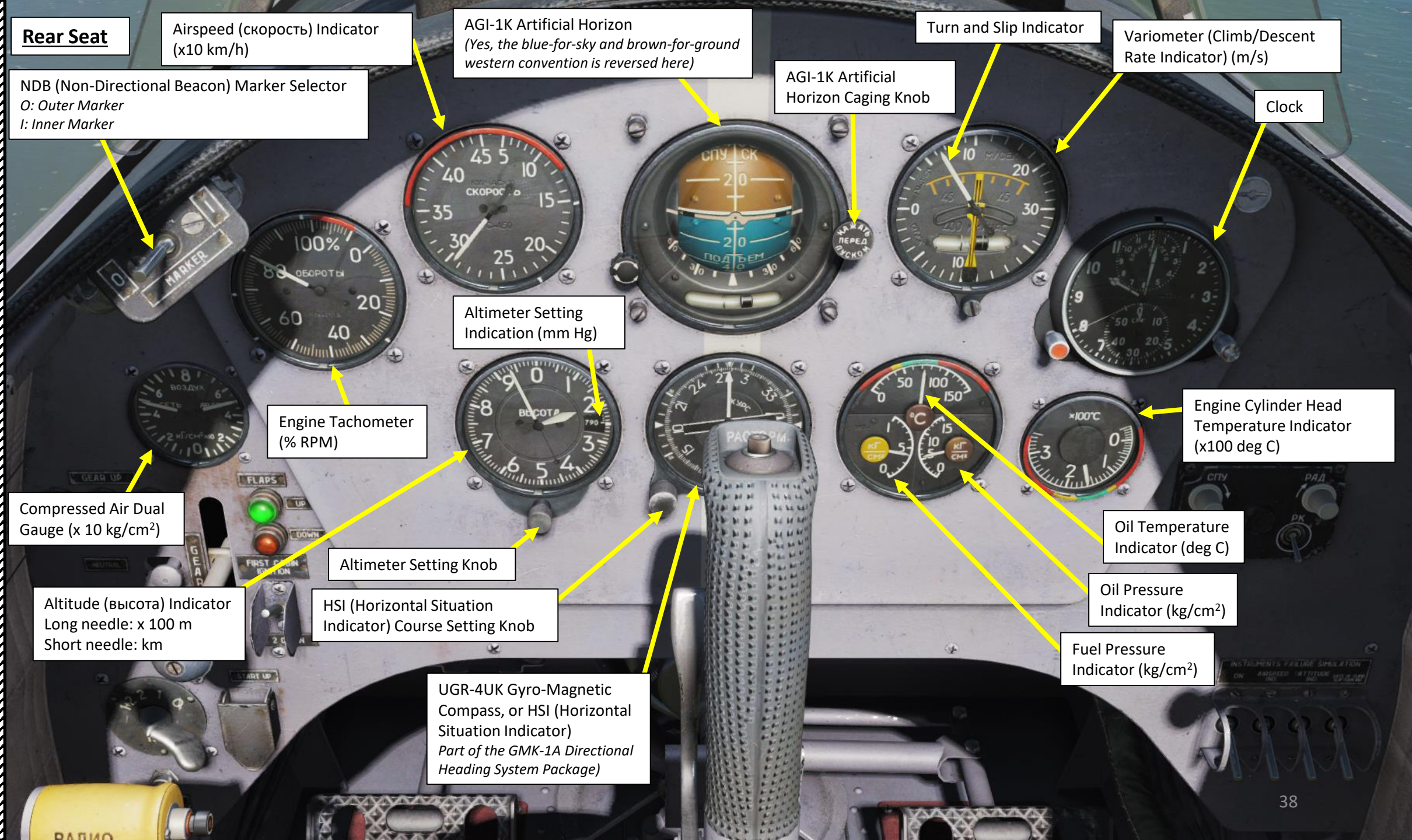
Warning Lights		
MAX G (G Limit Warning)	STALL (Aircraft stall Warning)	DANGER SPEED (Overturning Speed Warning Light)
GENER FAULT (Generator Fault, appears when engine RPM is too low for generator to kick in or during an actual generator failure)	FUEL 12 LTR (12 Litres of fuel remaining on left tank)	FUEL 12 LTR (12 Litres of fuel remaining on right tank)
BATTERY ON	GYRO WARN (Do not use gyro-compass if illuminated)	METAL CHIPS (metal chip Detected in oil system)
PITOT TUBE HEAT (ON)	STALL HEAT (ON)	




Rear Seat
VHF Radio Antenna


Rear Seat
ARK-15M Radio Compass Control Panel
ARK-15 Signal Light
ARK-15 ADF Mode Switch
COMP (КОМП): Radio-compass
ANT (АНТ): Antenna
ARK-15 Radio Compass ADF (Automatic Direction Finder) Transfer Control Button
ARK-15 ADF Loop (рамка) Button
Allows audio monitoring of the loop antenna output for direction finding b
ear, based on signal fade in and out if the Compass mode fails
Emergency Landing Gear Extension Valve
ARK-15 ADF Channel Selector Knob
ARK-15 Receiver Identification Mode Switch
TLG (ТЛГ): Telegraph/Morse Code Identification
TLF (ТЛФ): Telephony/Voice
ARK-15 ADF Audio Volume (громкость) Knob


Rear Seat
SPU-9 Intercom Control Panel
РАД: Radio Volume Knob
РК: ADF (Automatic Direction Finder) Switch
UP = ON / DOWN = OFF
Instruments Failure Simulation Panel
These switches are used by the instructor pilot to simulate instrument failures
СПУ : SPU-9 Intercom Volume
SPU-9 Intercom Mode
Stand-by (UP) / MAIN (DOWN)
Instrument Failure System Switch
UP: ON
DOWN: OFF
Airspeed Indicator Instrument Failure Switch
UP: ON
DOWN: OFF
VD-10K Altimeter and DA-30 Variometer Instrument Failure Switch
UP: ON
DOWN: OFF
AGI-1 Artificial Horizon (Attitude Indicator) Instrument Failure Switch
UP: ON
DOWN: OFF


Rear Seat
Airspeed (скорость) Indicator (x10 km/h)
AGI-1K Artificial Horizon
(Yes, the blue-for-sky and brown-for-ground western convention is reversed here)
Turn and Slip Indicator
Variometer (Climb/Descent Rate Indicator) (m/s)
NDB (Non-Directional Beacon) Marker Selector
O: Outer Marker
I: Inner Marker
AGI-1K Artificial Horizon Caging Knob
Clock
Altimeter Setting Indication (mm Hg)
Engine Tachometer (% RPM)
Engine Cylinder Head Temperature Indicator (x100 deg C)
Compressed Air Dual Gauge (x 10 kg/cm²)
Oil Temperature Indicator (deg C)
Altimeter Setting Knob
Oil Pressure Indicator (kg/cm²)
Altitude (высота) Indicator
Long needle: x 100 m
Short needle: km
HSI (Horizontal Situation Indicator) Course Setting Knob
Fuel Pressure Indicator (kg/cm²)
UGR-4UK Gyro-Magnetic Compass, or HSI (Horizontal Situation Indicator)
Part of the GMK-1A Directional Heading System Package)

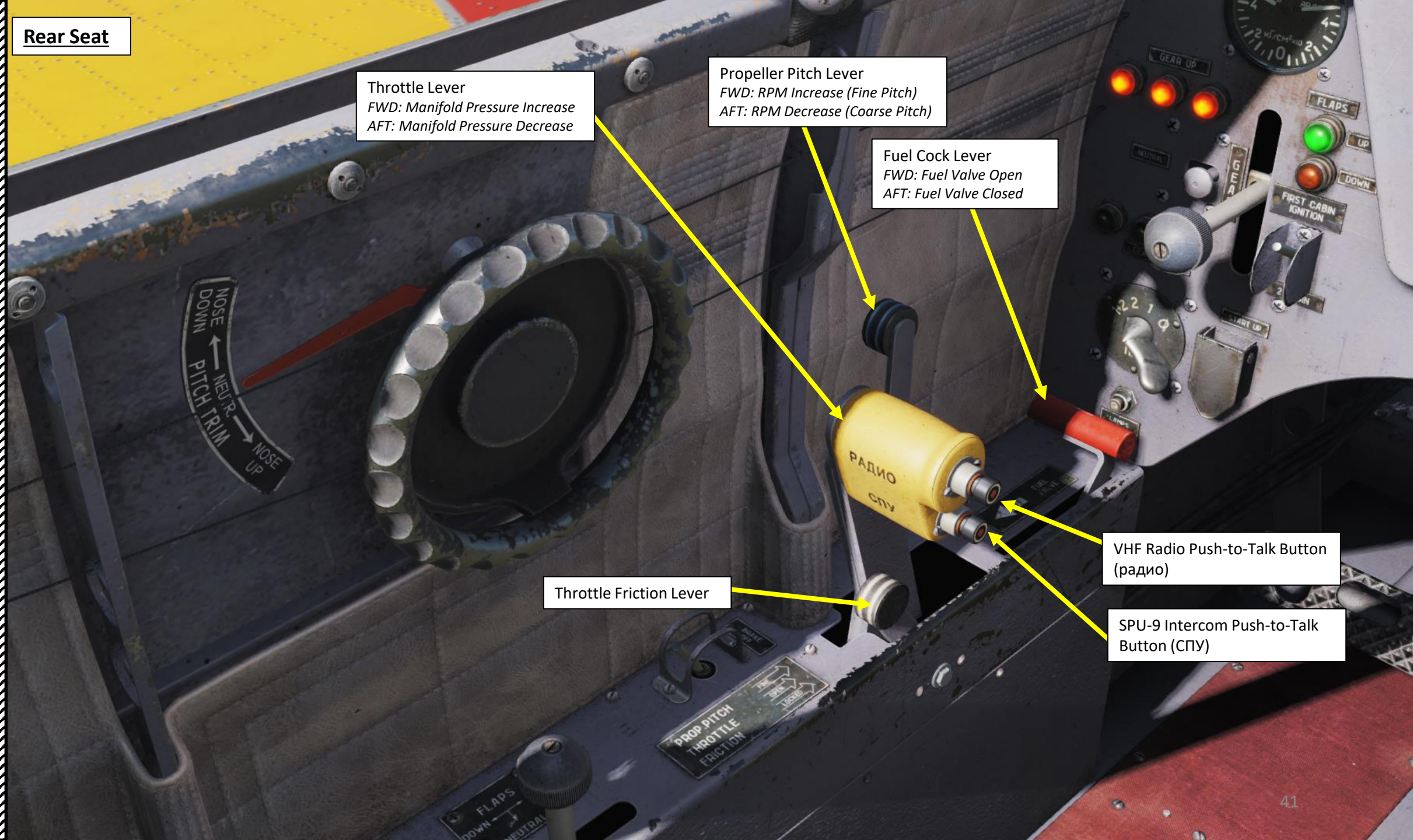
Rear Seat


Landing Gear Lever
UP: Landing Gear Retracted
MIDDLE: Landing Gear Neutral
DOWN: Landing Gear Deployed
Landing Gear Up Indicator
Flaps Up Indicator
Flaps Down Indicator
Landing Gear – Neutral Position Mechanical Lock
Landing Gear Down Indicator
MARKER
FLAPS
GEAR UP
FIRST CABIN IGNITION
РАДИО
СПУ

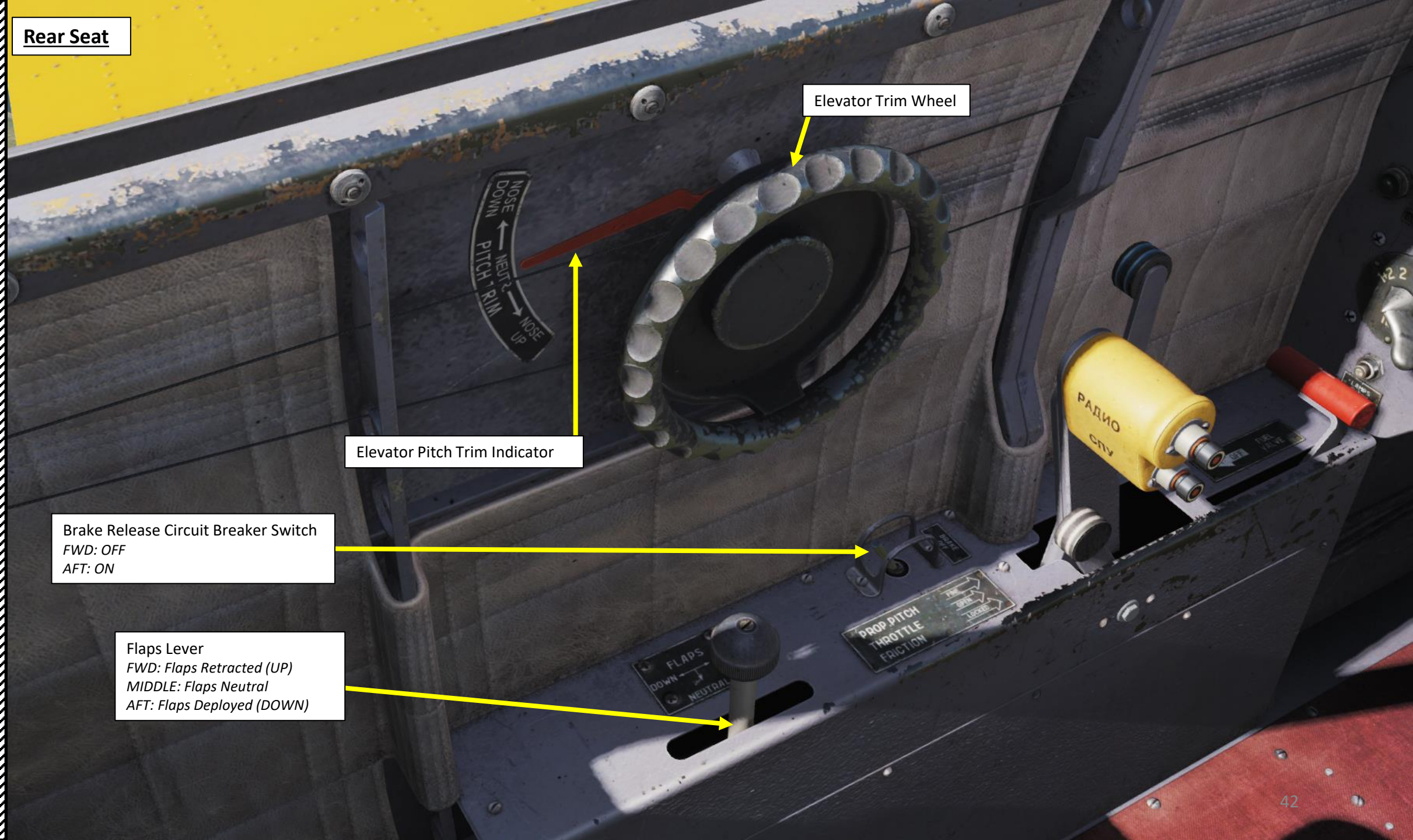
Rear Seat


MARKER
GEAR UP
FLAPS
FIRST CABIN IGNITION
Magneto Switch
Lamps Test Switch
Ignition Control Switch
• UP: First cabin (front seat) ignition switch controls ignition
• DOWN: Second cabin (rear seat) ignition switch controls ignition
Starter Switch
(with cover guard)

Rear Seat


Throttle Lever
FWD: Manifold Pressure Increase
AFT: Manifold Pressure Decrease
Propeller Pitch Lever
FWD: RPM Increase (Fine Pitch)
AFT: RPM Decrease (Coarse Pitch)
Fuel Cock Lever
FWD: Fuel Valve Open
AFT: Fuel Valve Closed
VHF Radio Push-to-Talk Button (радио)
Throttle Friction Lever
SPU-9 Intercom Push-to-Talk Button (СПУ)
NOSE DOWN
NEUTR
NOSE UP
PITCH TRIM
РАДИО
СПУ
PROP PITCH
THROTTLE
FRICTION
FLAPS
GEAR UP
FLAPS
UP
DOWN
FIRST CABIN IGNITION
START UP

Rear Seat



Elevator Trim Wheel

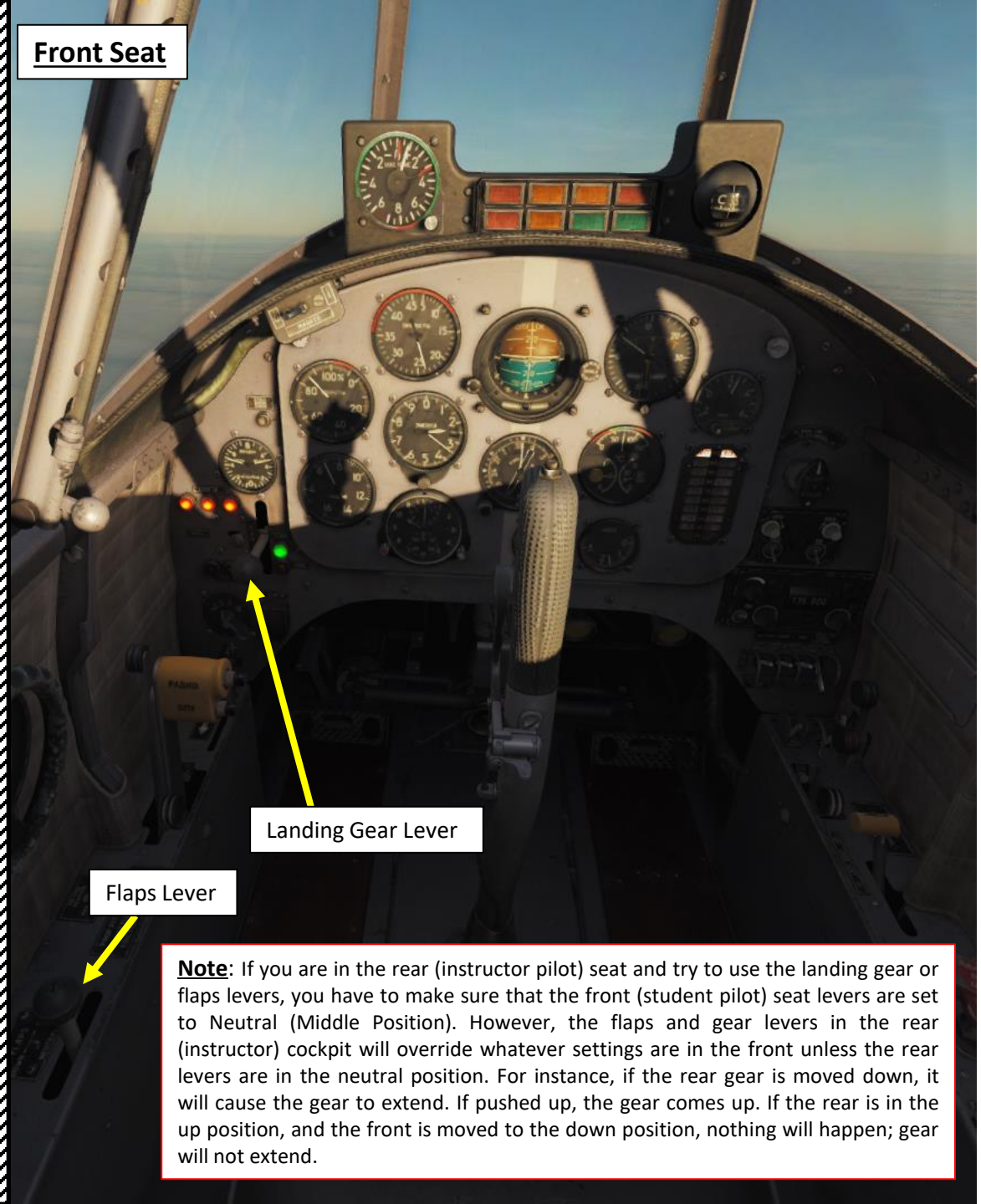
Elevator Pitch Trim Indicator

Brake Release Circuit Breaker Switch
FWD: OFF
AFT: ON

Flaps Lever
FWD: Flaps Retracted (UP)
MIDDLE: Flaps Neutral
AFT: Flaps Deployed (DOWN)


Rear Seat
PORTABLE LAMP
КОНТРОЛЬ АРК
ADF Connection Block

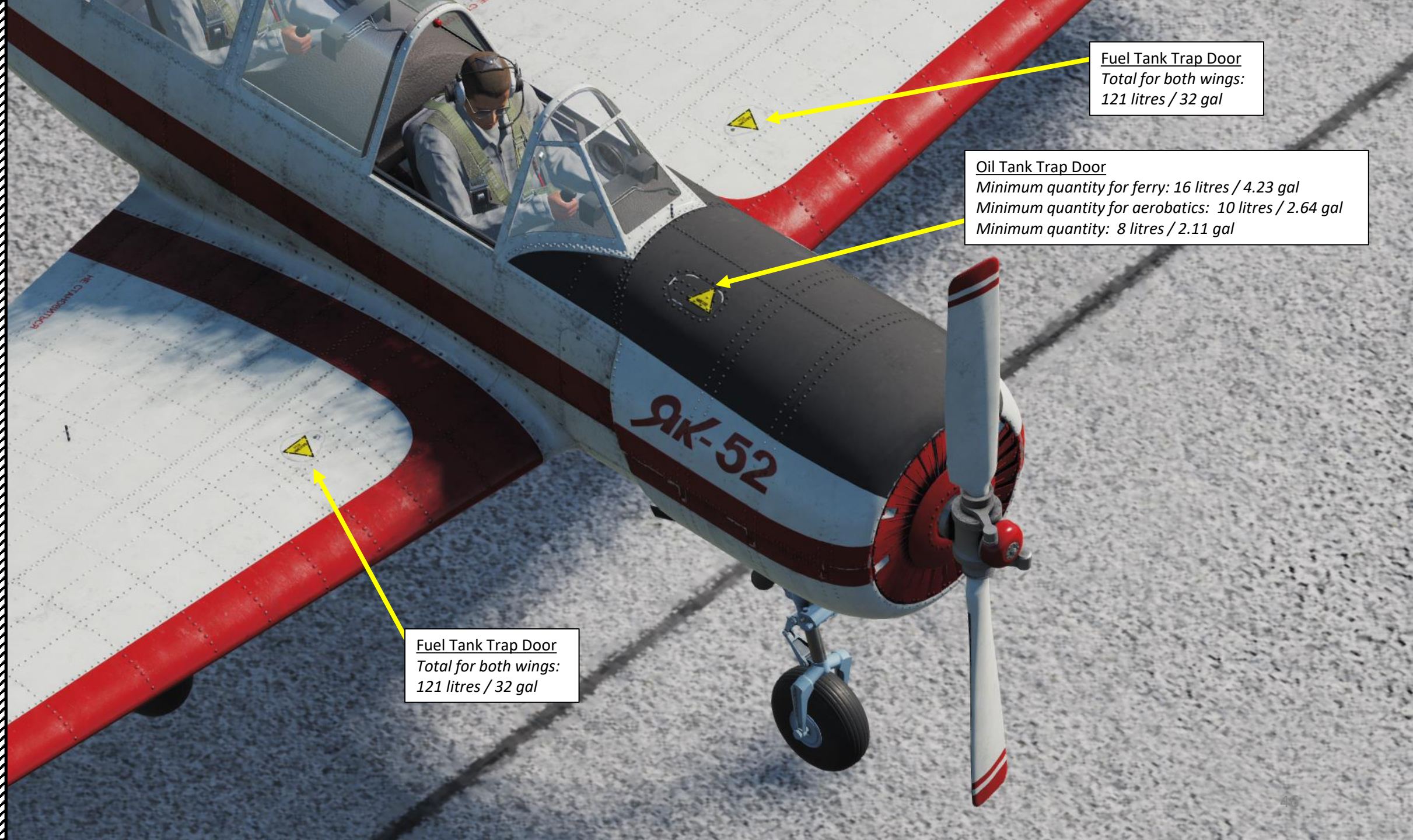
Front Seat



Note: If you are in the rear (instructor pilot) seat and try to use the landing gear or flaps levers, you have to make sure that the front (student pilot) seat levers are set to Neutral (Middle Position). However, the flaps and gear levers in the rear (instructor) cockpit will override whatever settings are in the front unless the rear levers are in the neutral position. For instance, if the rear gear is moved down, it will cause the gear to extend. If pushed up, the gear comes up. If the rear is in the up position, and the front is moved to the down position, nothing will happen; gear will not extend.

Rear Seat


Pitot Tube
Aileron
Aileron
Elevator
Elevator
Rudder

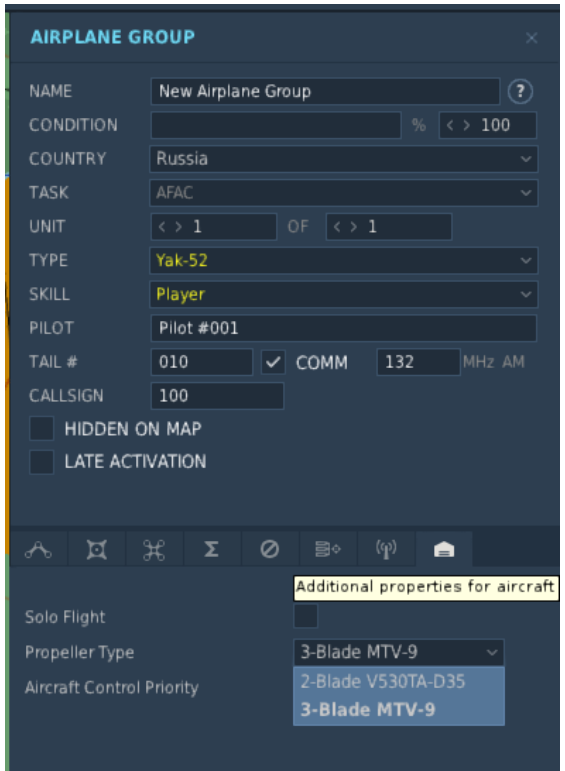

Fuel Tank Trap Door
Total for both wings:
121 litres / 32 gal
Oil Tank Trap Door
Minimum quantity for ferry: 16 litres / 4.23 gal
Minimum quantity for aerobatics: 10 litres / 2.64 gal
Minimum quantity: 8 litres / 2.11 gal
Fuel Tank Trap Door
Total for both wings:
121 litres / 32 gal
ЯК-52

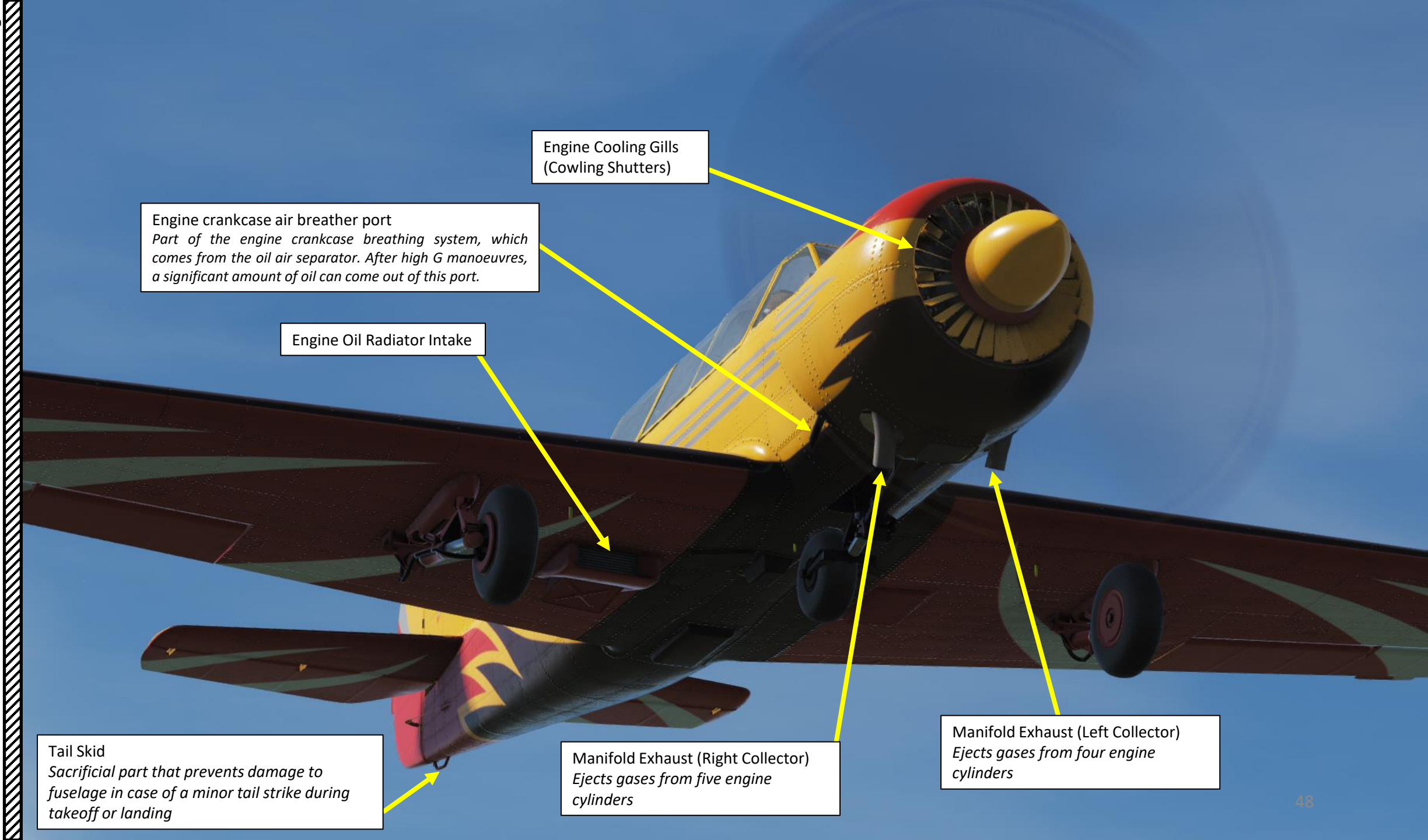
PROPELLERS

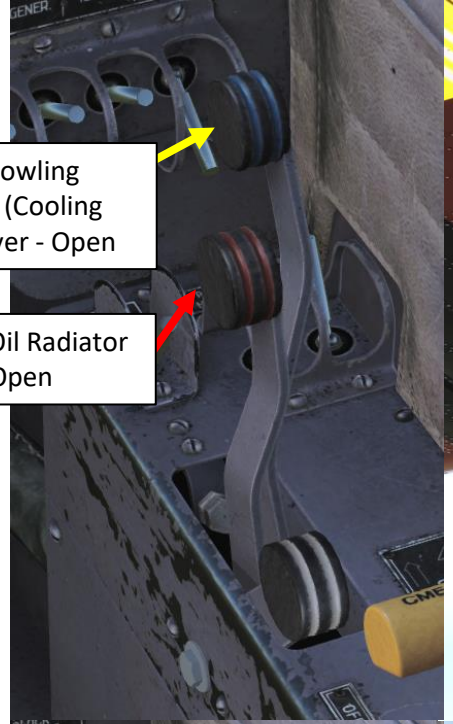
- The Yak-52 comes with two available propellers: a **two-blade V530TA-D35** propeller and a **three-blade MTV-9** propeller. Prop types are set via the mission editor.

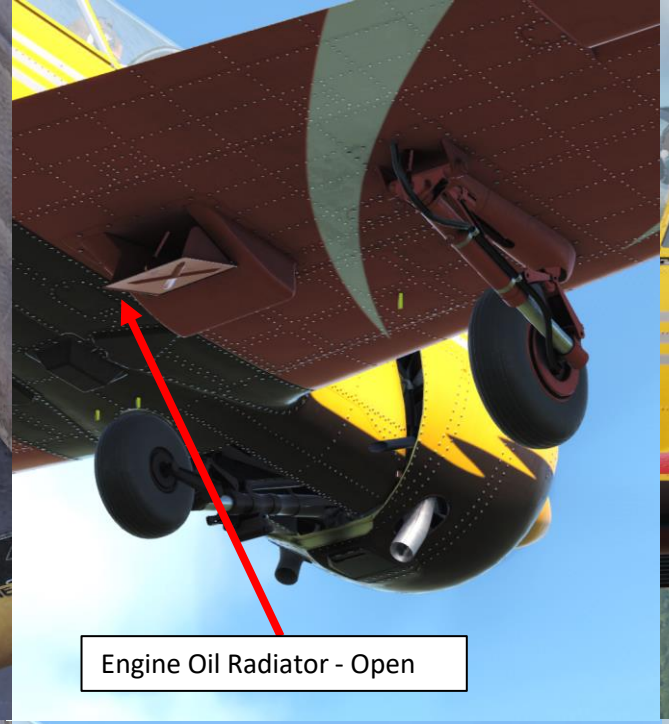
- Compared to a two-bladed propeller, a slightly smaller three-bladed propeller can produce more thrust at a given RPM, improving climb performance. However, the three-blade design is substantially heavier, and adds forward moment to the weight and balance.

- A two-bladed prop is more efficient aerodynamically speaking since it has a lower propeller blade area (less drag), which can result in a higher aircraft cruising speed. A two-blade propeller produces two pressure pulses per revolution, where a three-blade propeller will produce three smaller pulses per revolution (for the same amount of total thrust) which is inherently smoother and therefore quieter. The three-blade propeller will generally have a smaller diameter than the 2-blade propeller that it replaces, which also reduces the tip speed and noise.

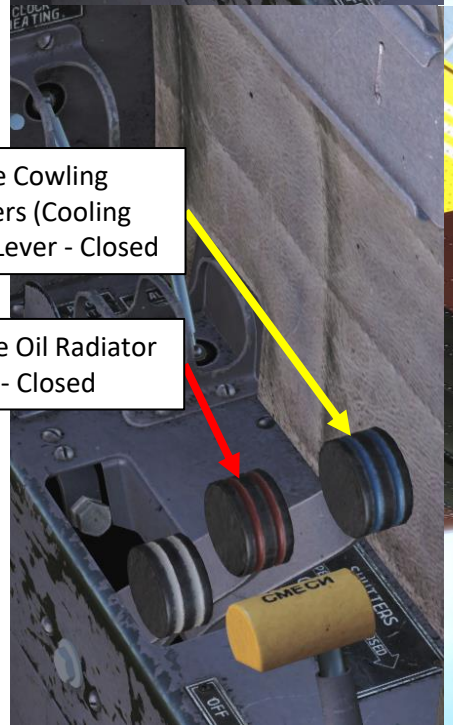


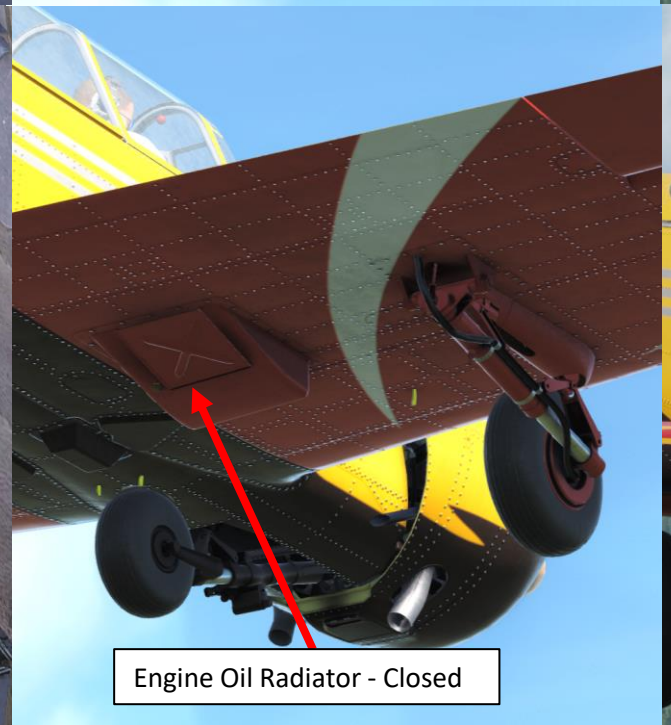

Engine Cooling Gills
(Cowling Shutters)
Engine crankcase air breather port
Part of the engine crankcase breathing system, which comes from the oil air separator. After high G manoeuvres, a significant amount of oil can come out of this port.
Engine Oil Radiator Intake
Tail Skid
Sacrificial part that prevents damage to fuselage in case of a minor tail strike during takeoff or landing
Manifold Exhaust (Right Collector)
Ejects gases from five engine cylinders
Manifold Exhaust (Left Collector)
Ejects gases from four engine cylinders


Engine Cowling Shutters (Cooling Gills) Lever - Open
Engine Oil Radiator Lever - Open


Engine Oil Radiator - Open

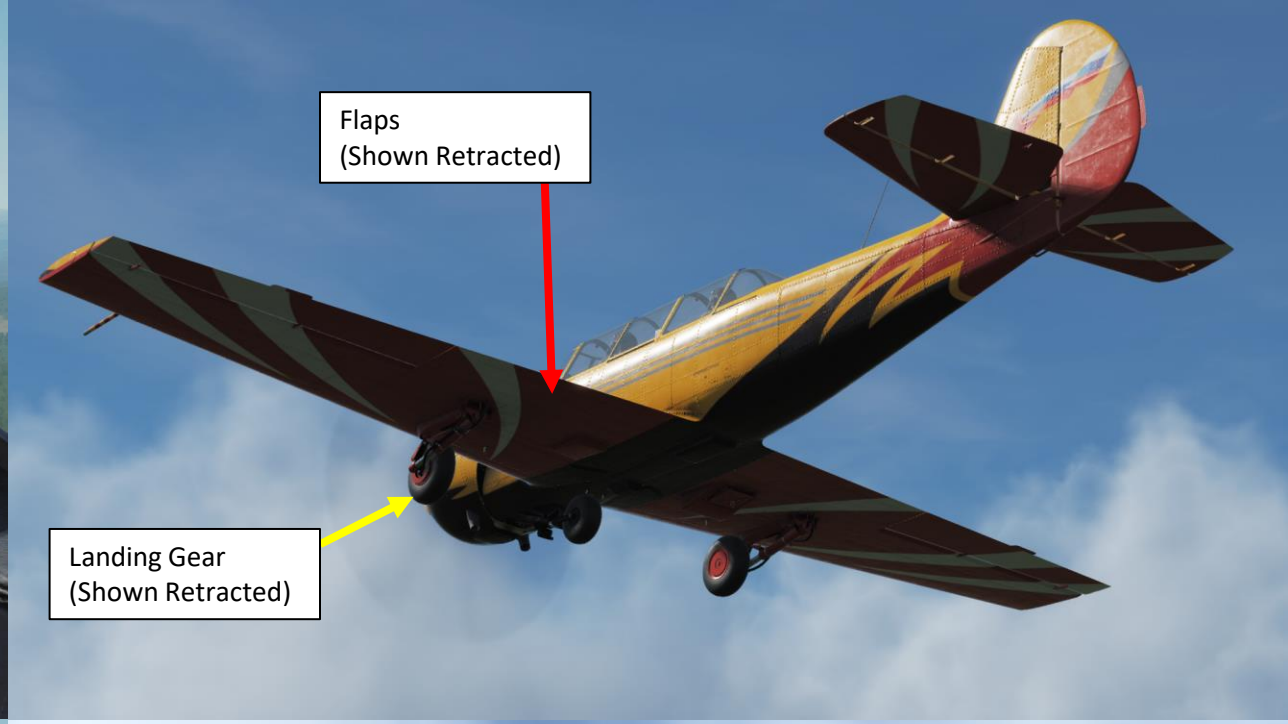

Engine Cowling Shutters (Cooling Gills) - Open


Engine Cowling Shutters (Cooling Gills) Lever - Closed
Engine Oil Radiator Lever - Closed

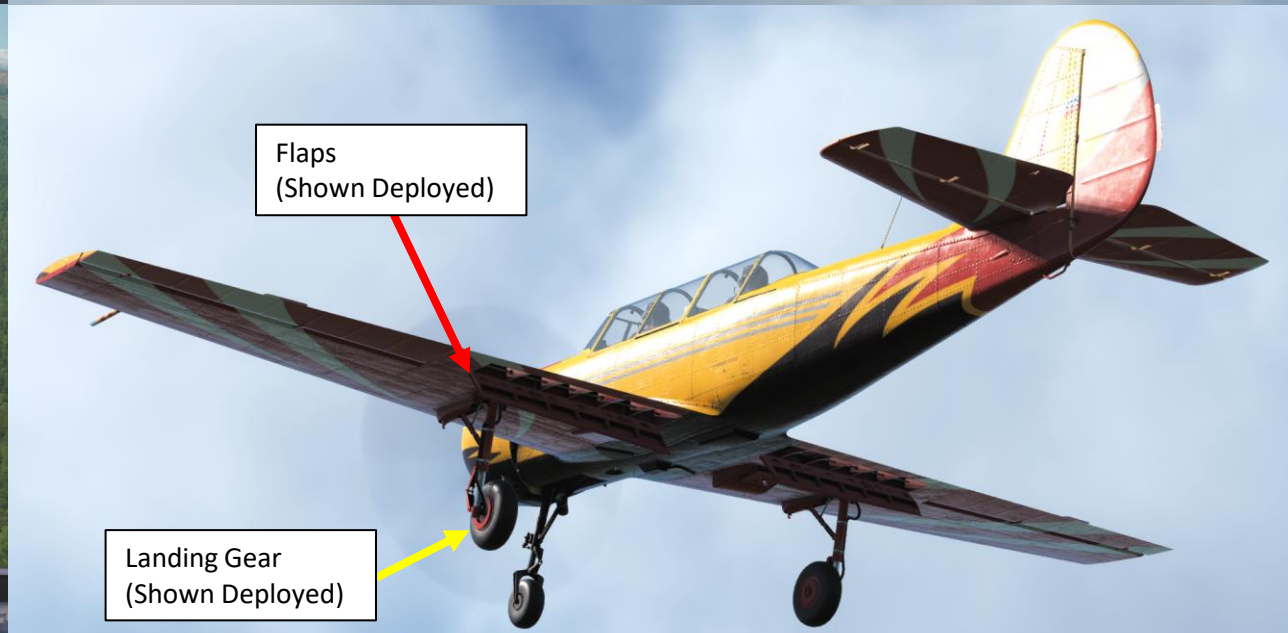

Engine Oil Radiator - Closed


Engine Cowling Shutters (Cooling Gills) - Closed


Landing Gear Mechanical Indicator (Shown Deployed)


Flaps (Shown Retracted)
Landing Gear (Shown Retracted)


Landing Gear Mechanical Indicator (Shown Deployed)


Flaps (Shown Deployed)
Landing Gear (Shown Deployed)

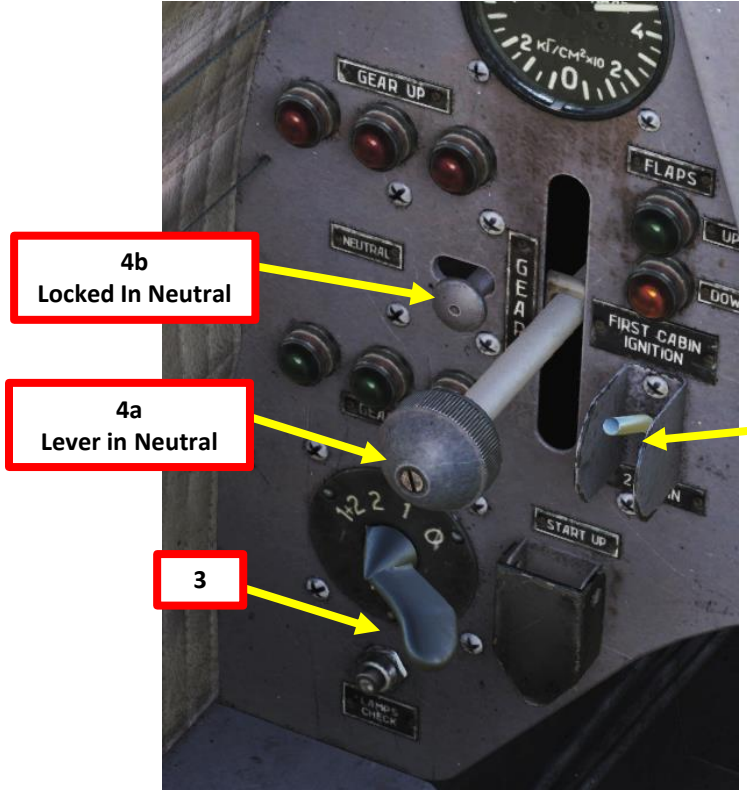
PART 4 – START-UP

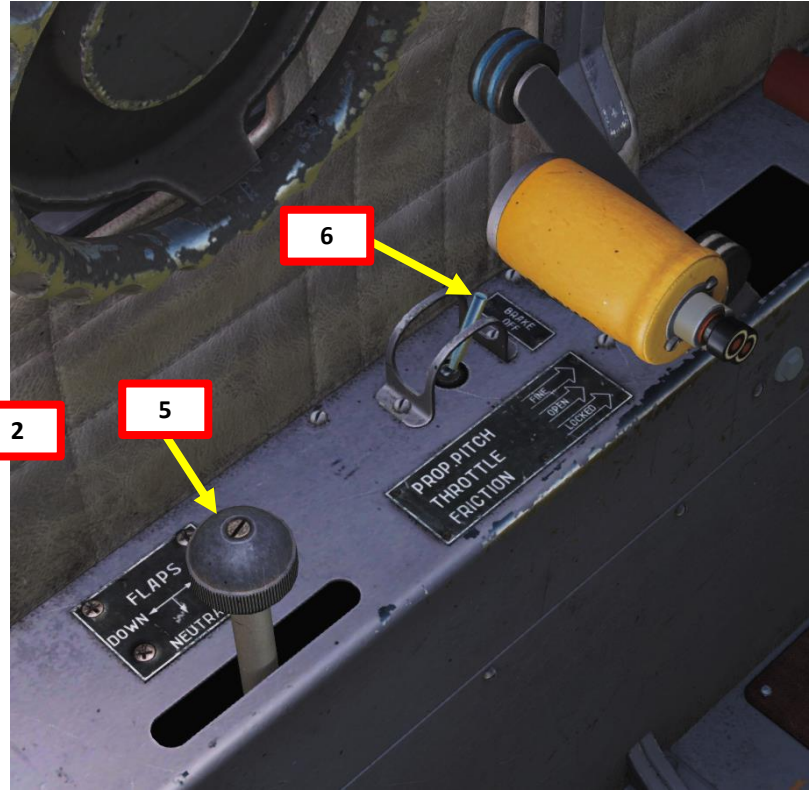
Livery: Russian Roolettes' VH-XRO "Drac's Yak"
Created by PorcoRosso86

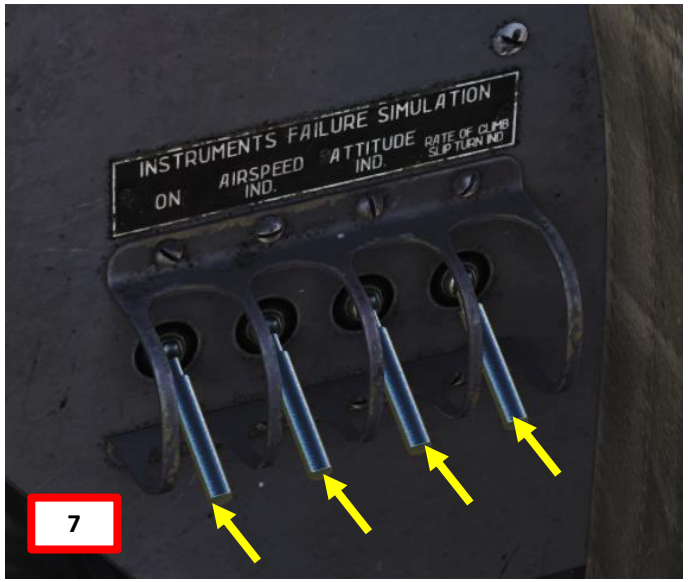
PRE-FLIGHT

Note: Checks 1 through 7 are not mandatory in DCS since we assume that the aircraft is always set up correctly. In real life, such checks should be made during your walkaround to make sure that there is no lever or switch in the rear cockpit left in an incorrect position (i.e. issues with flaps and landing gear levers). Some items of the walkaround (like oil quantity check) will also be omitted due to the limitations of the sim.

1. Press “2” to occupy rear seat
2. Verify that Ignition Control Switch is set to UP (First Cabin/Front Seat controls ignition)
3. In the rear seat, verify that Magneto switch is set to 1+2.
4. In the rear seat, verify that Landing Gear lever is set to Neutral (Middle position) and that the lock is set.
5. In the rear seat, verify that Flaps lever is set to Neutral (Middle position).
6. In the rear seat, set Brake Release Circuit Breaker Switch to OFF (FWD)
7. In the rear seat, verify that all Instruments Failure Simulation switches are DOWN (OFF)

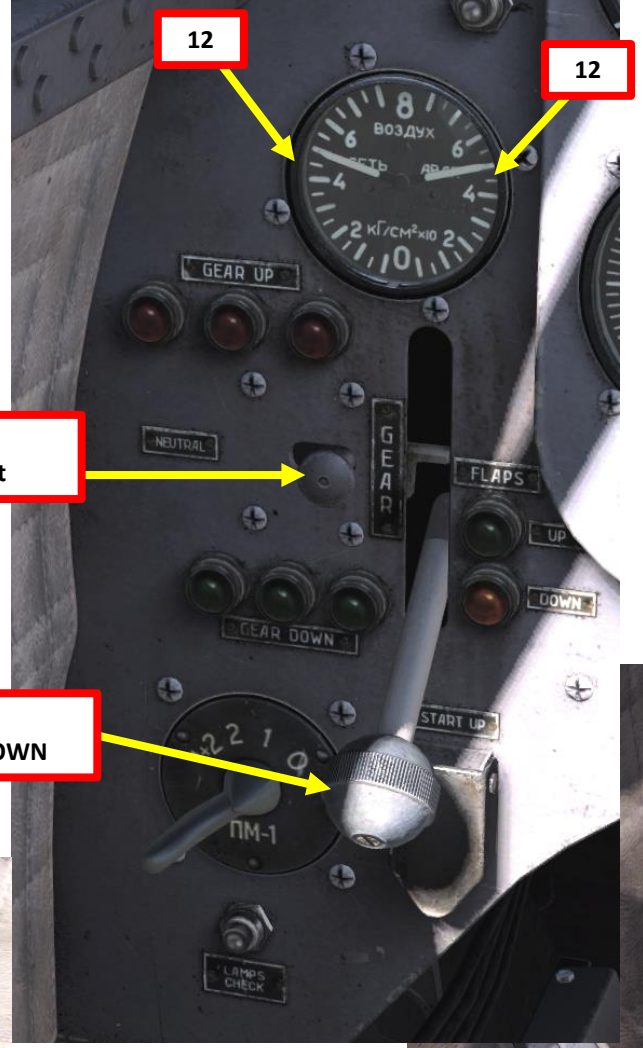


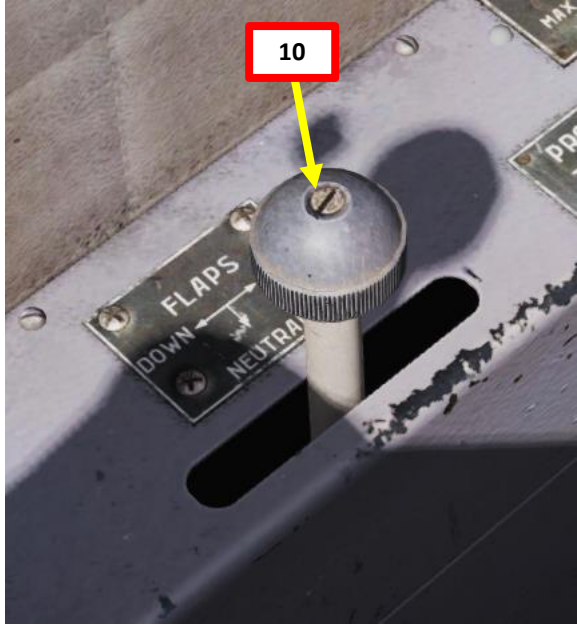


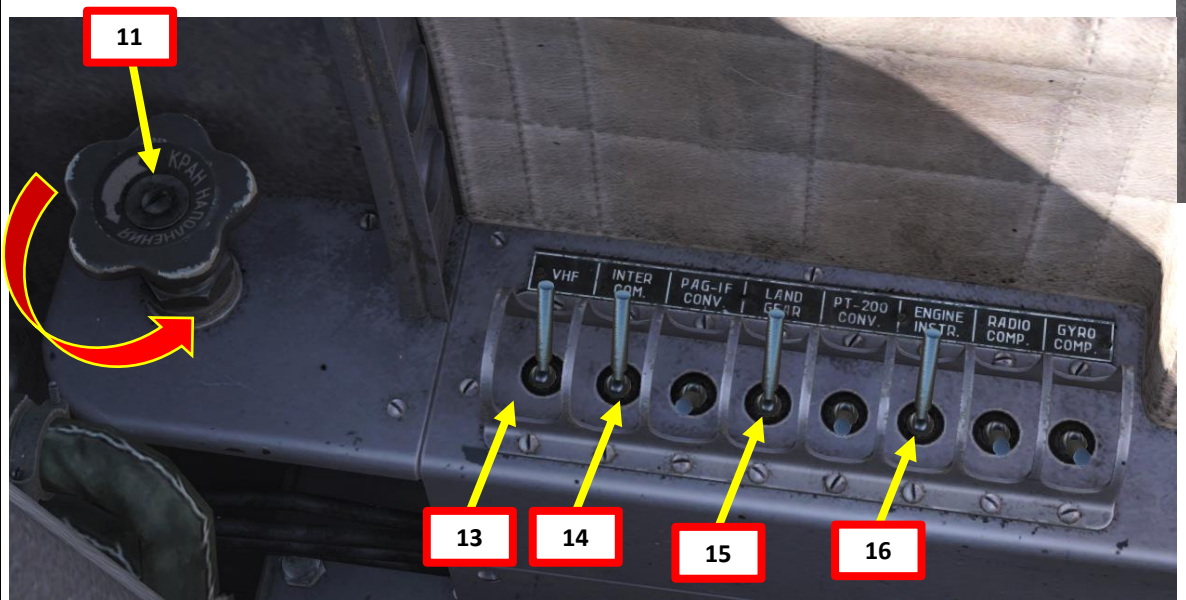


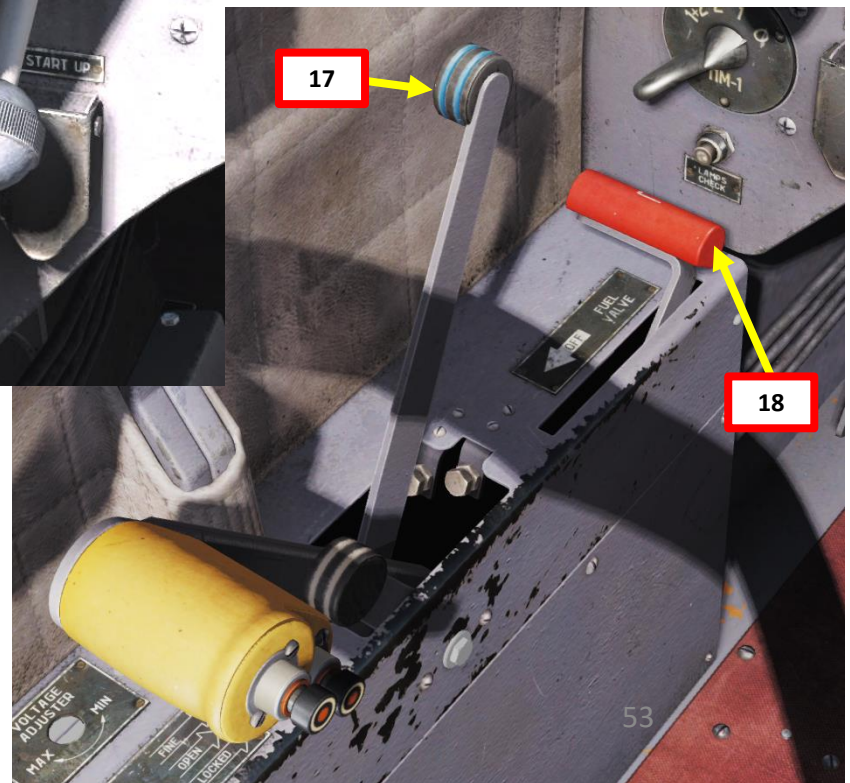
PRE-FLIGHT

8. Press “1” to occupy front seat
9. Verify that Landing Gear lever is set to DOWN (Down position) and that the lock is set.
10. Verify that Flaps lever is set to Neutral (Middle position).
11. Open Main Pneumatic Air System Valve (Air Fuel Cock) by rotating the wheel counter-clockwise.
12. Confirm that Compressed Air Dual Gauge shows a pneumatic pressure of at least 50 kg/cm^2 for both the Main Air System and the Emergency Air System.
13. Set VHF Radio Circuit Breaker Switch (No. 1) – ON
14. Set Intercom Circuit Breaker Switch (No. 2) – ON
15. Set Landing Gear Circuit Breaker Switch (No. 4) – ON
16. Set Engine Instruments Circuit Breaker Switch (No. 6) – ON
17. Set Propeller Lever – Full Forward (Fine Pitch)
18. Set Fuel Cock Lever – Forward (Open)



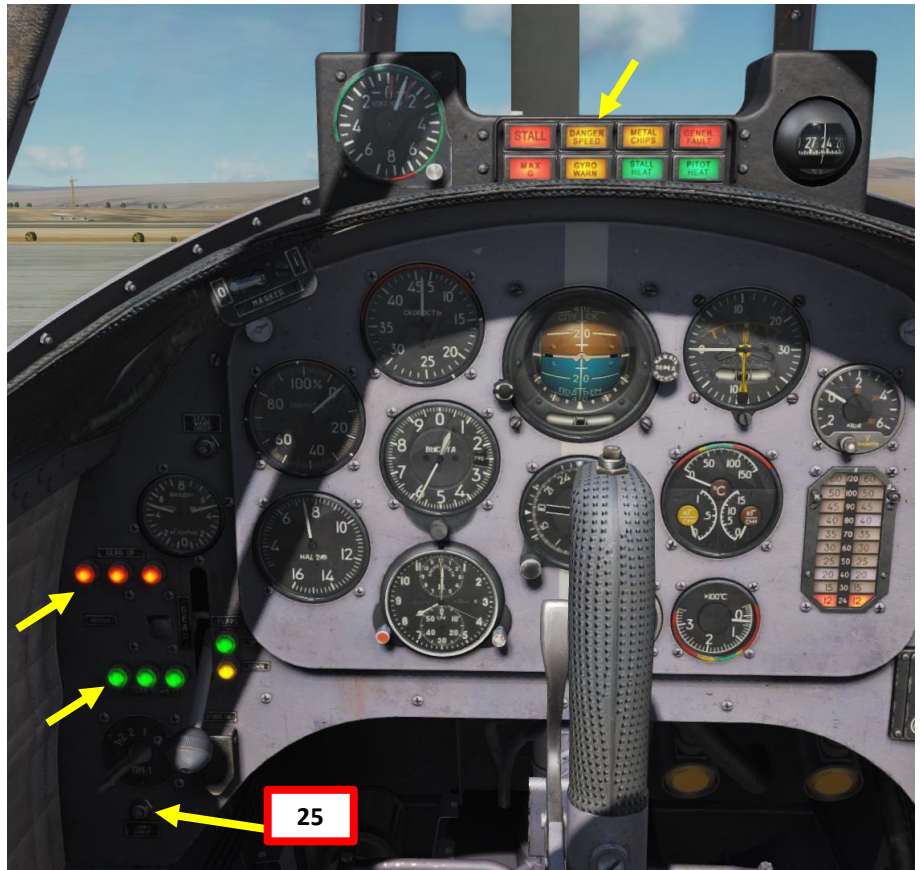


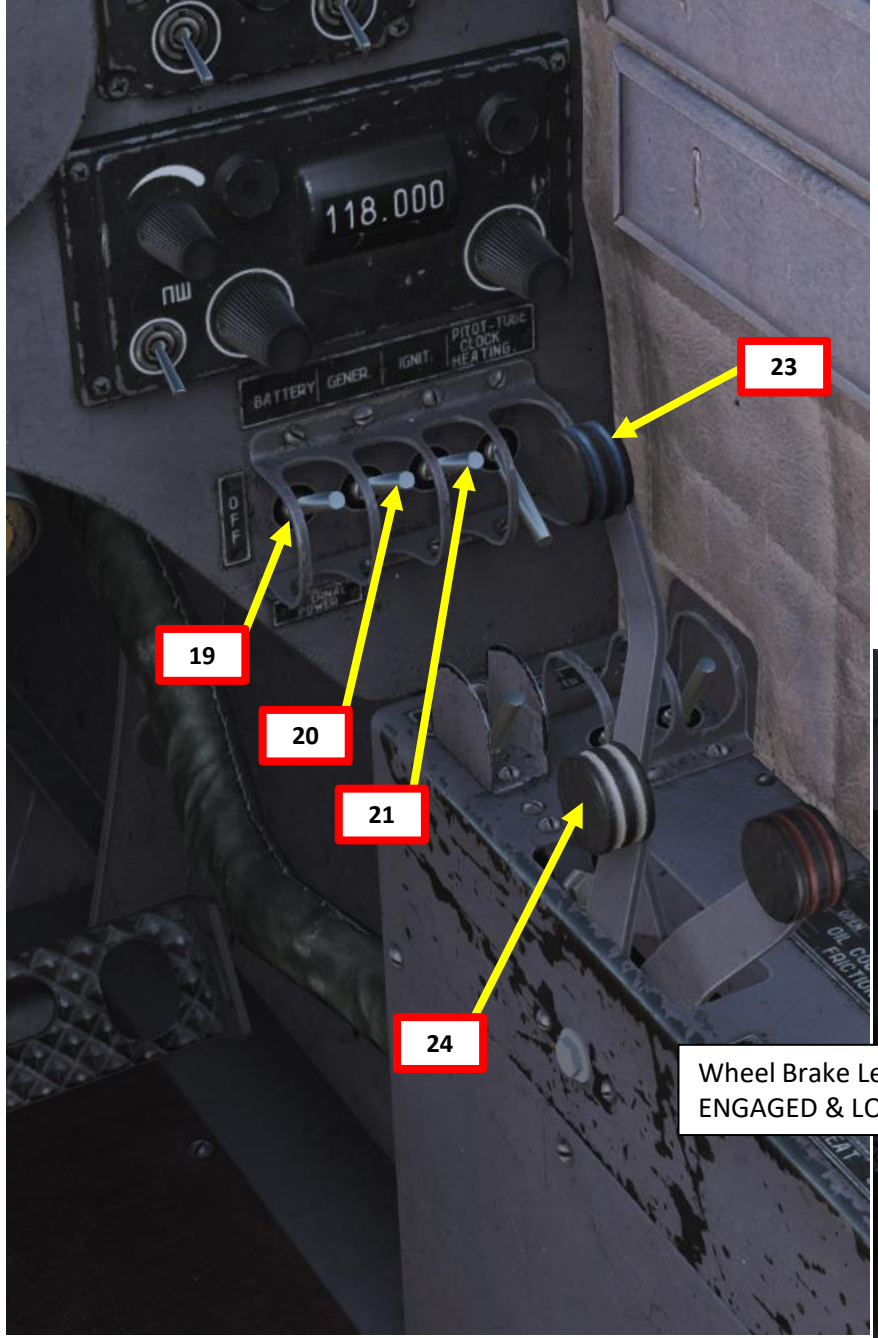


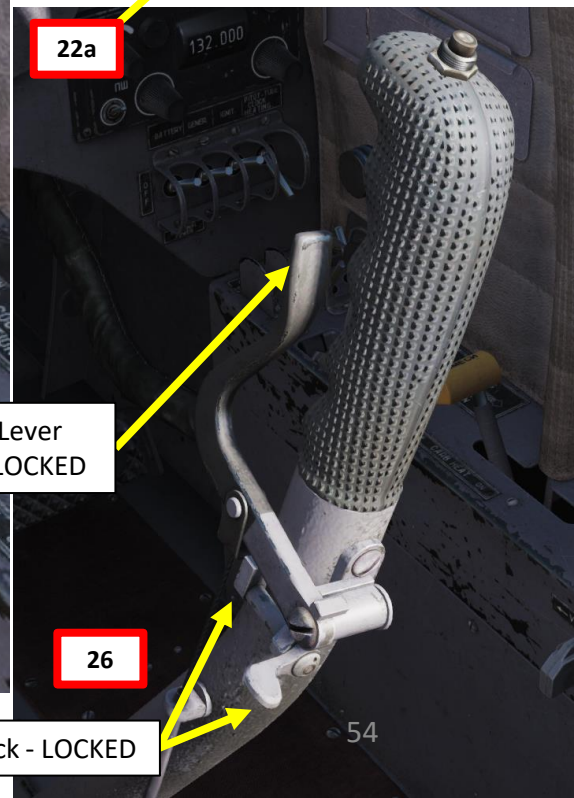


PRE-FLIGHT

19. Set Battery Switch – UP (BATTERY ON)
20. Set Generator Switch – UP (ON)
21. Set Ignition Switch – UP (ON)
22. Press and hold Voltammeter Mode button and verify that Battery Voltage is at least 24 Volts (Shown: 27 V)
23. Set Engine Cowling Shutters (Cooling Gills) Lever – Full Forward (OPEN)
24. Adjust Friction Lever to Middle Position (will prevent cowling shutter lever from moving back during engine start)
25. Press the Lamps Test switch and verify that cockpit advisories illuminate properly.
26. Verify that Brakes are Locked







ENGINE START

The Yak-52 uses an air-driven pneumatic starter. Each time an engine start is attempted, the air pressure available is expended (reduced) to drive the prop until you eventually run out of air pressure. During hot weather, the engine is usually relatively cooperative.

However, when attempting an engine start in the morning on a cold engine or in winter conditions, the engine oil is usually very thick and viscous, which makes the starter's job more difficult. This means that if the engine does not start after successive attempts, in real life someone would have to do the (unenviable) task of manually moving the propeller by hand while the pilot is priming the engine cylinders.

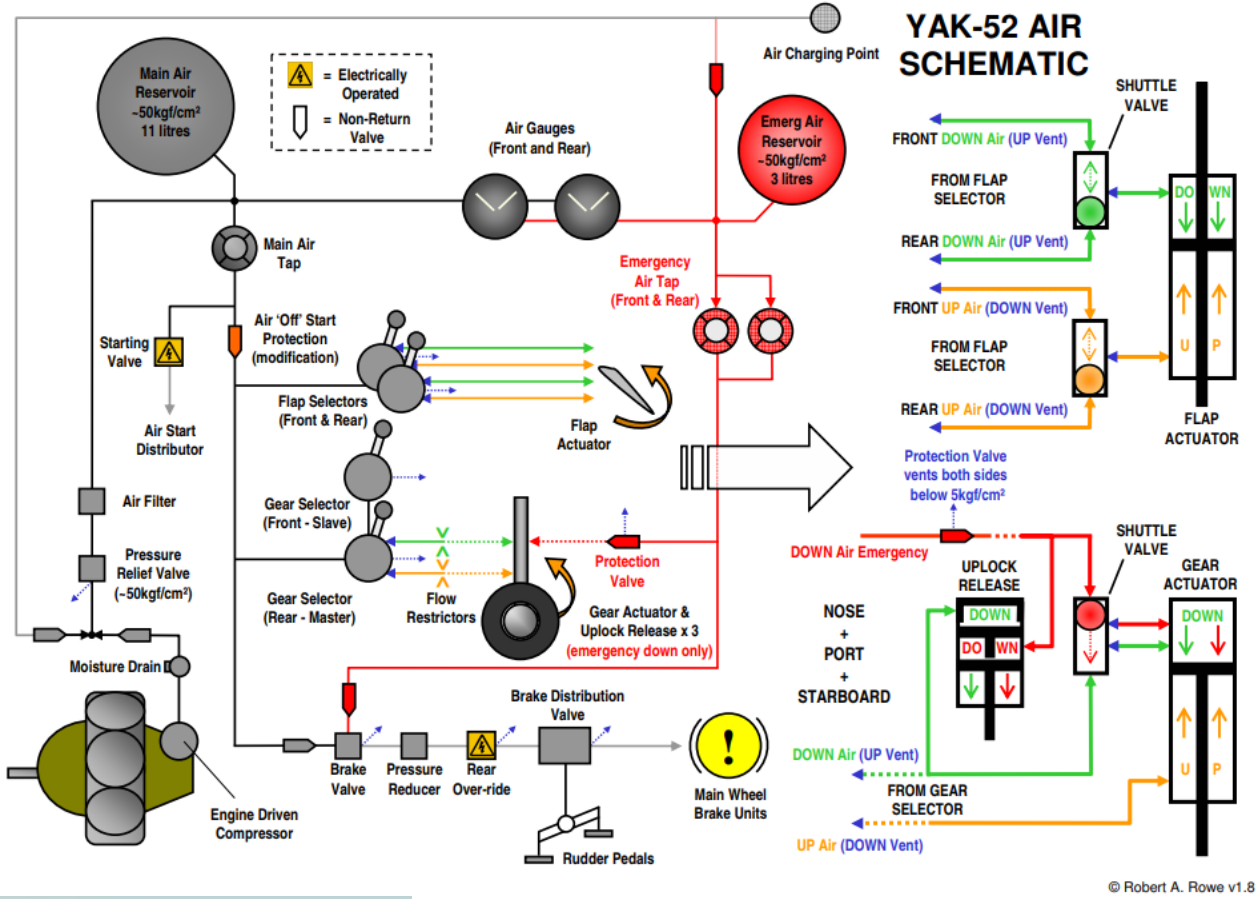
Video: https://youtu.be/lRpoXcP3VRc

The technique regarding propeller blade pulls in between primes varies with different schools of thought. The Russian method where you always have a ground crew available is to pull 1 blade between each cylinder prime. If you don't have crew, then what you can do is give 5 cylinder primes, then jump outside and pull 5 blades through, then hop back in the cockpit. This should give you about 30 seconds of fuel vaporization (converting fuel from a liquid state into vapor) time. Then, you would pump up the main fuel lines, then give another couple of primes then start.

The idea of the blade pulls is to distribute the fuel prime along the induction manifold and into the cylinders via the inlet valve. Prime is sprayed in by an injector right next to the No. 9 cylinder inlet valve. If you don't pull blades, the vapor just sits in one spot.

Take note that some pilots don't bother with blade pulls and still get ok starts. However, some pilots get better more consistent starts with Blade pulls.

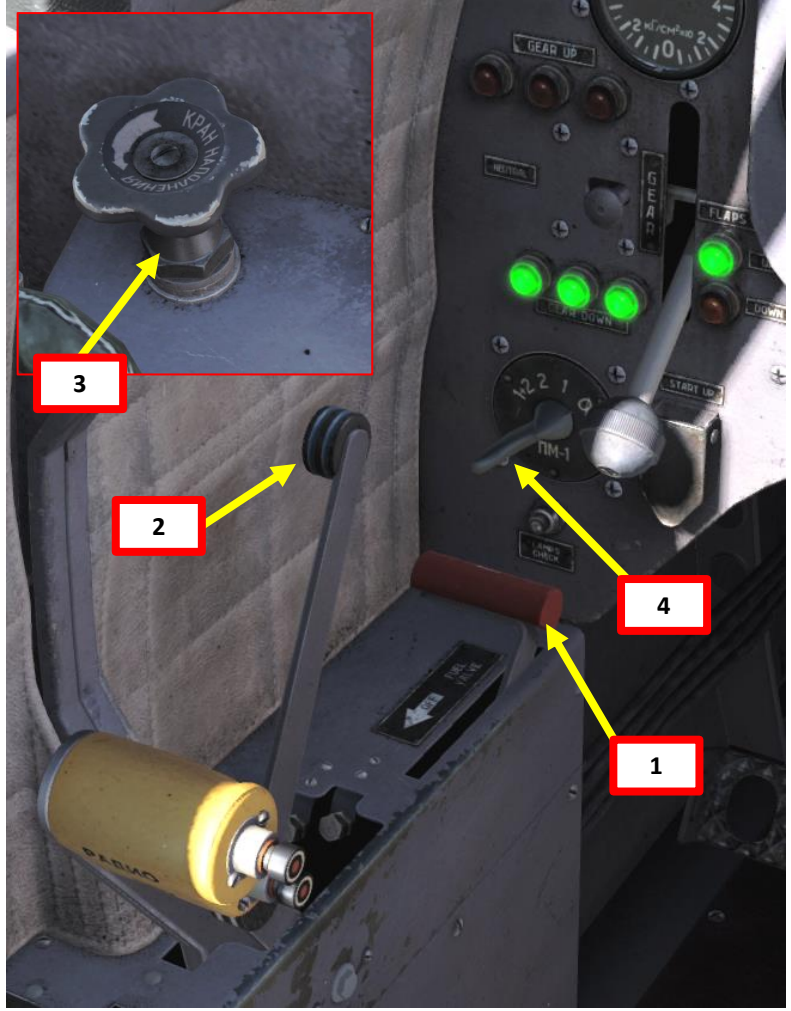
So far the blade pulling is not modelled in DCS, but I thought it was a neat random bit of trivia.

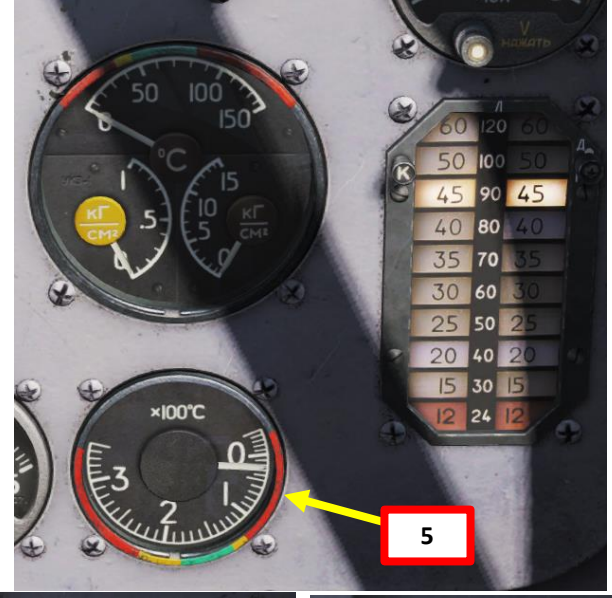


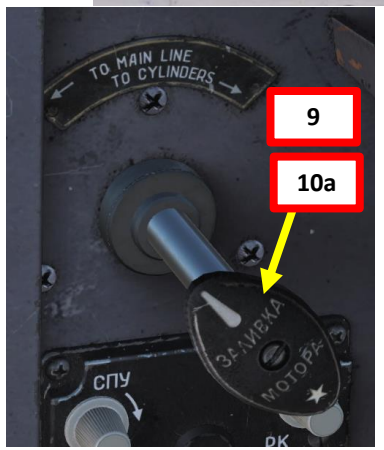
Compressed Air Dual Gauge
(x 10 kg/cm^2)
LEFT: Main Air System Pressure
RIGHT: Emergency Air System Pressure

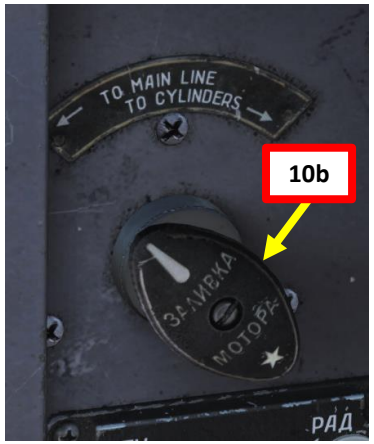
ENGINE START

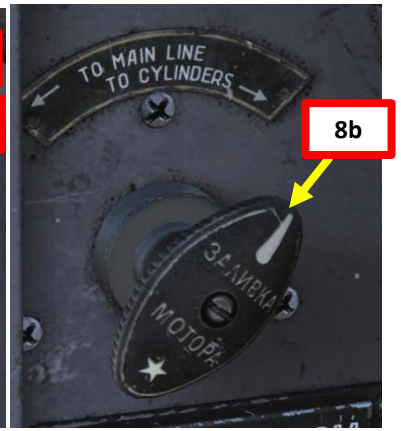
1. Verify that Fuel Cock Lever is set – Forward (Open)
2. Verify that Propeller Lever is set – Full Forward (Fine Pitch)
3. Verify that Main Pneumatic Air System Valve (Air Fuel Cock) is fully open
4. Verify that the Magneto switch is set to 0 (OFF)
5. Check CHT (Cylinder Heat Temperature) gauge and note the current OAT (Outside Air Temperature). In this tutorial we are roughly at 20 deg C.
6. If OAT is below 0 deg C (freezing temperature), set Carburettor Heat Lever ON (AFT). Otherwise, leave it at OFF (FWD).
7. Scroll mousewheel to rotate the Fuel Priming Pump handle right in the “TO CYLINDERS” position.
8. Pull and push the Fuel Priming Pump handle based on the current OAT using this rule of thumb:
   - No. of Strokes = (100 – OAT)/10 = (100 – 20) / 10 = 8 times
   - In plain English: prime cylinders once for each 10-degree increment that you need to reach 100 deg C Cylinder Head Temperature.
9. Scroll mousewheel to rotate the Fuel Priming Pump handle left in the “TO MAIN LINE” position
10. Pull and push the Fuel Priming Pump handle until the Fuel Pressure indicator reads between 0.2 and 0.5 kg/cm^2 at the carburettor inlet (about 3 strokes in our case).
    - Note: Rule of thumb for main line priming is usually 5-6 times for summer operation and 8-12 times in winter.
11. Scroll mousewheel and lock the Fuel Priming Pump handle back in the center (OFF) position.

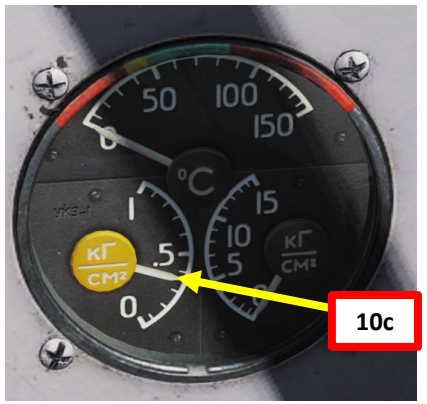


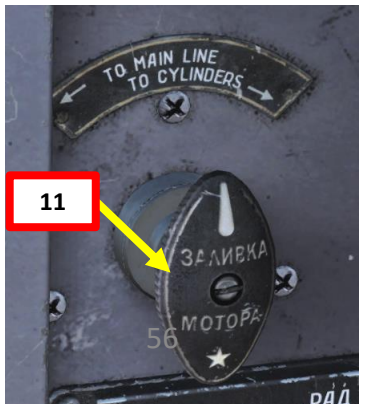






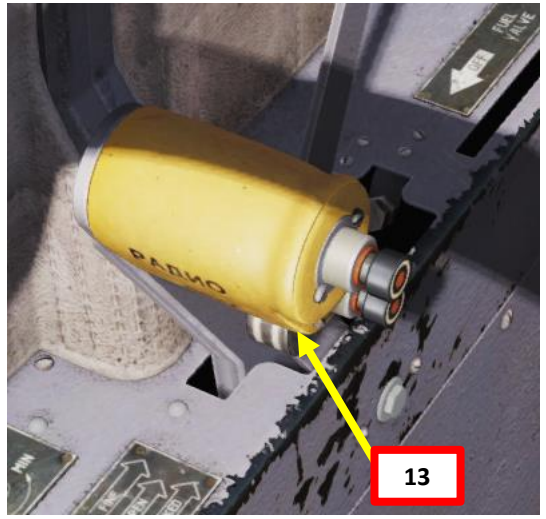


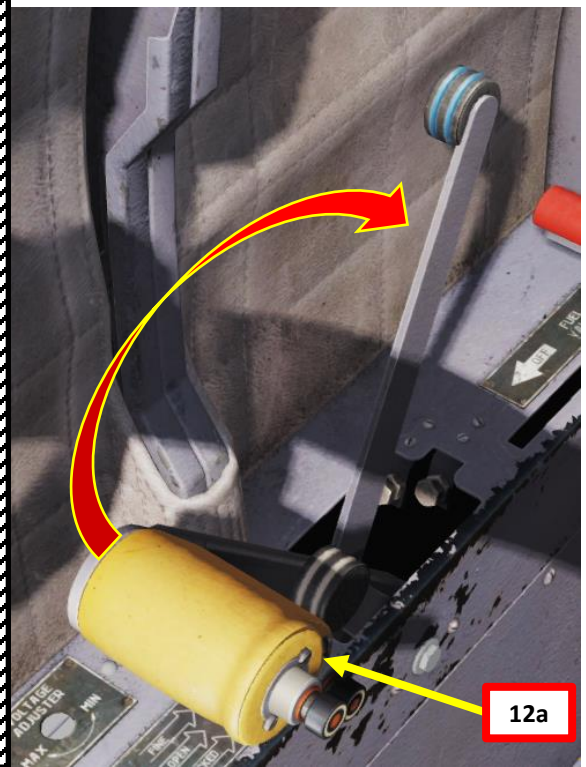


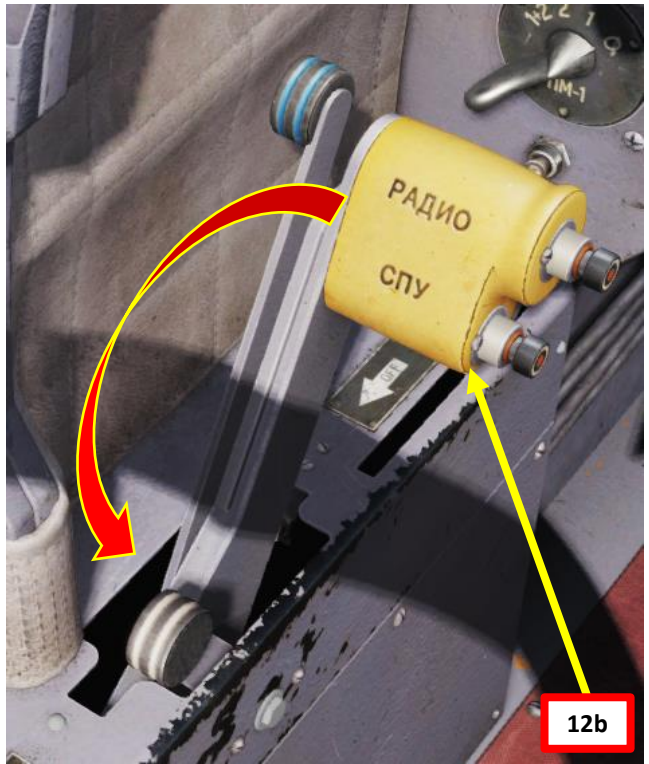


ENGINE START

12. Exercise the throttle through its full range of motion twice to ensure it moves correctly
13. Set throttle to about 1/3 of its full travel
14. Command « Clear prop! » to warn people around you that you are about to start the engine.
15. Flip the safety cover of the starter switch and hold the starter switch (HOME key) for the duration of the start
16. Wait for 2-3 revolutions of the propeller, then switch the Magneto switch to 1+2 (BOTH)
17. Adjust throttle to 40 % RPM for engine warm-up

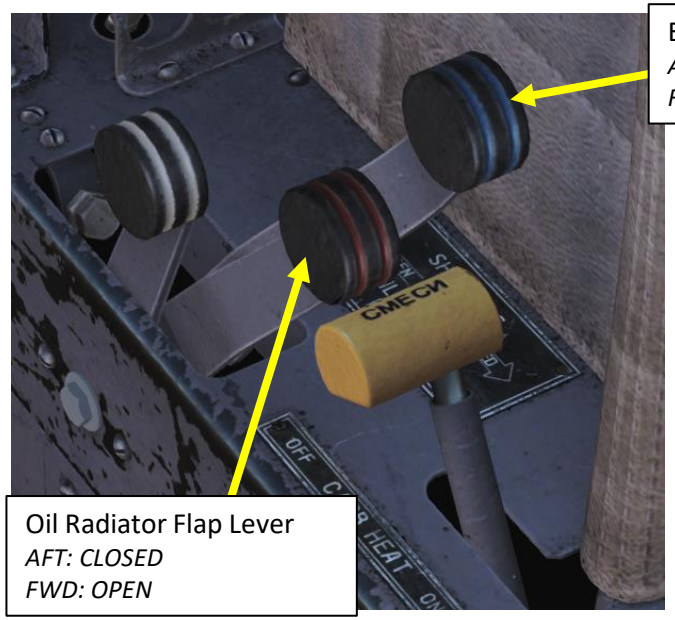


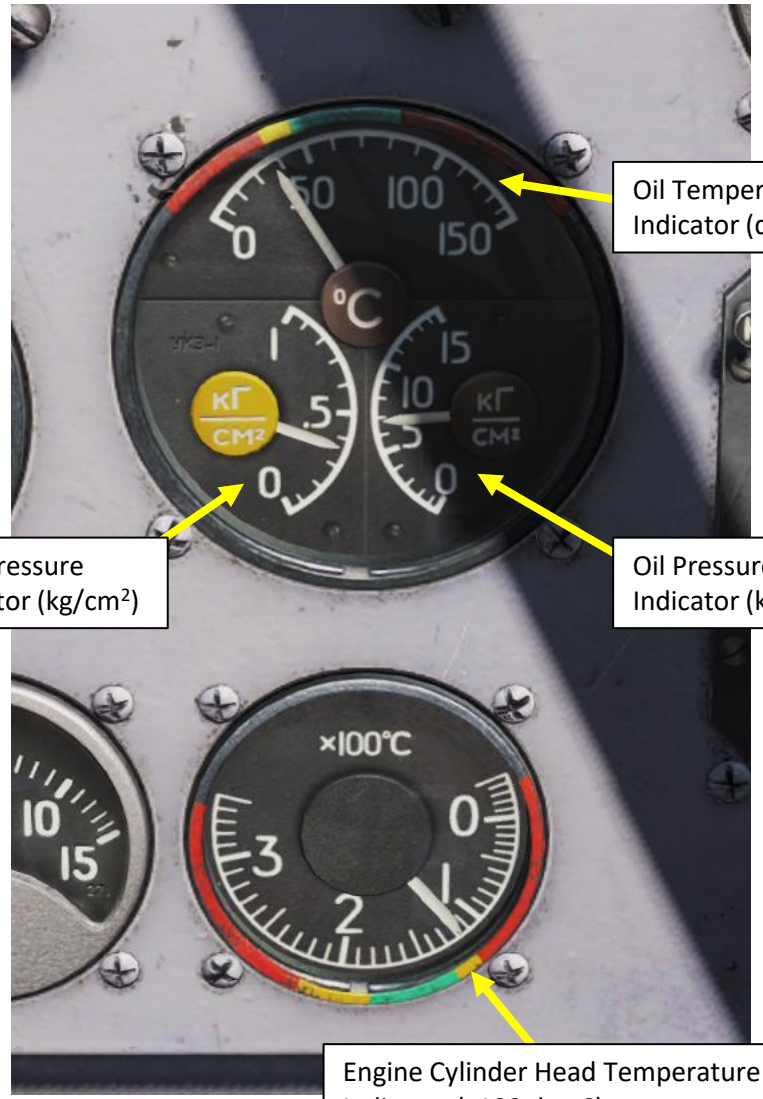




ENGINE START

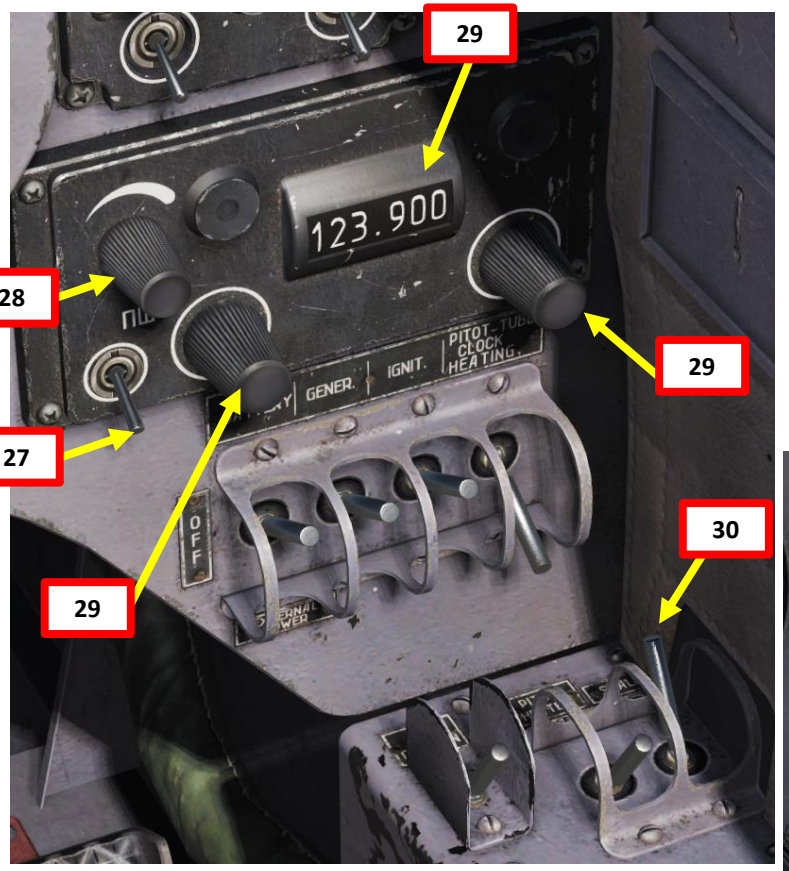
18. Adjust throttle to 44-48 % RPM for summer conditions or 44-51 % RPM for winter conditions. Wait until engine warms up and engine parameters reach:
    - Cylinder Head Temperature greater than 120 deg C
    - Oil Temperature greater than 40 deg C
    - Oil Pressure greater than 1 kg/cm^2
19. Note: you can close the Oil Radiator and Engine Cowling Shutters (Cooling Gills) by setting their levers AFT (CLOSED) to speed up the warm-up process of the engine.

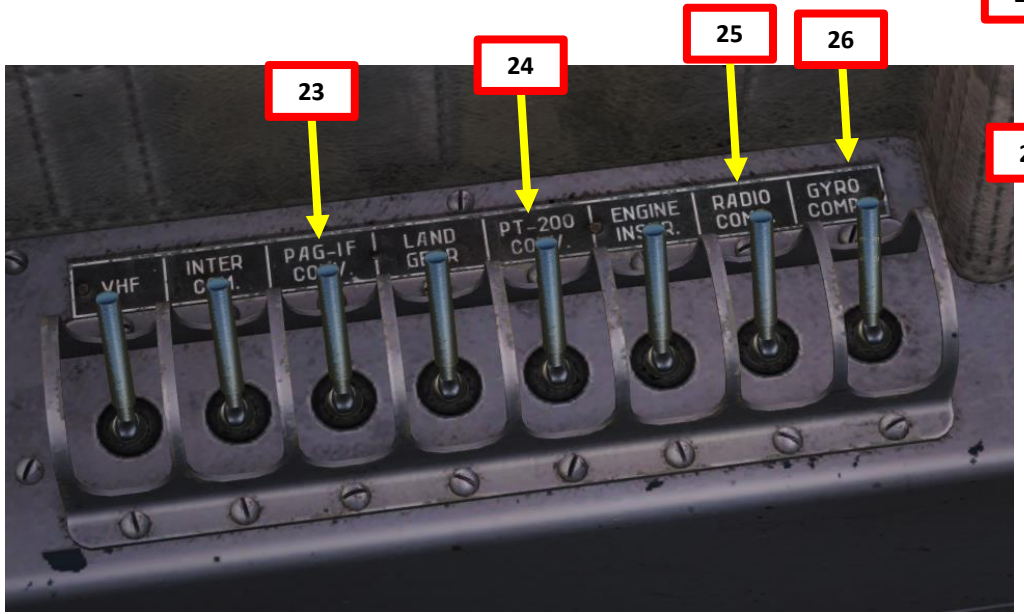




COMPLETE PRE-FLIGHT

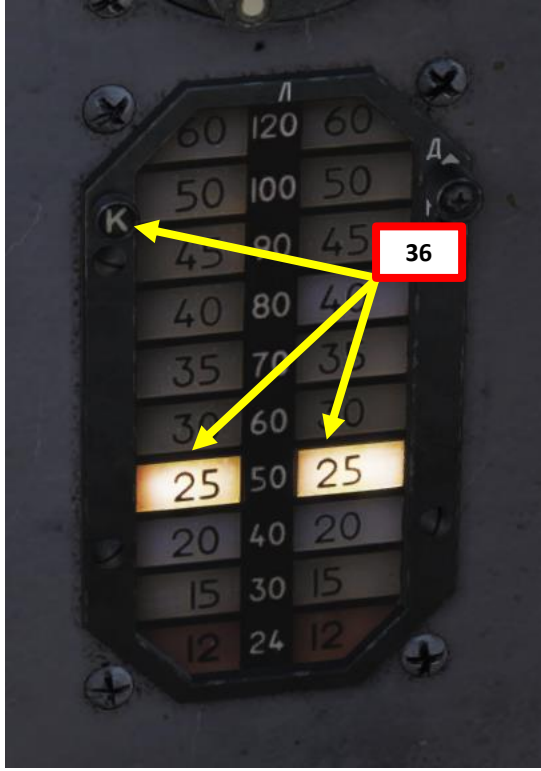
20. Open up Oil Radiator and Engine Cowling Shutters (Cooling Gills) setting the Oil Rad and Gill levers Forward (OPEN).
21. Adjust Altimeter Setting knob to set an altitude of 0 m.
22. Press the Accelerometer Reset button to set G-meter limits to their initial position.
23. Set PAG-1F Converter Switch – ON
24. Set PT-200 Converter Switch – ON
25. Set Radio-Compass (ARK-15M ADF) Switch – ON
26. Set Gyro-Compass (GMK-1AE) Switch – ON
27. Set VHF Radio Squelch Button – OFF (DOWN)
28. Set VHF Radio Volume Button – As required
29. Set VHF Radio Frequency – Tower Frequency
30. Set SSKUA-1 Stall Warning Switch – ON (FWD)
31. Uncage Artificial Horizon

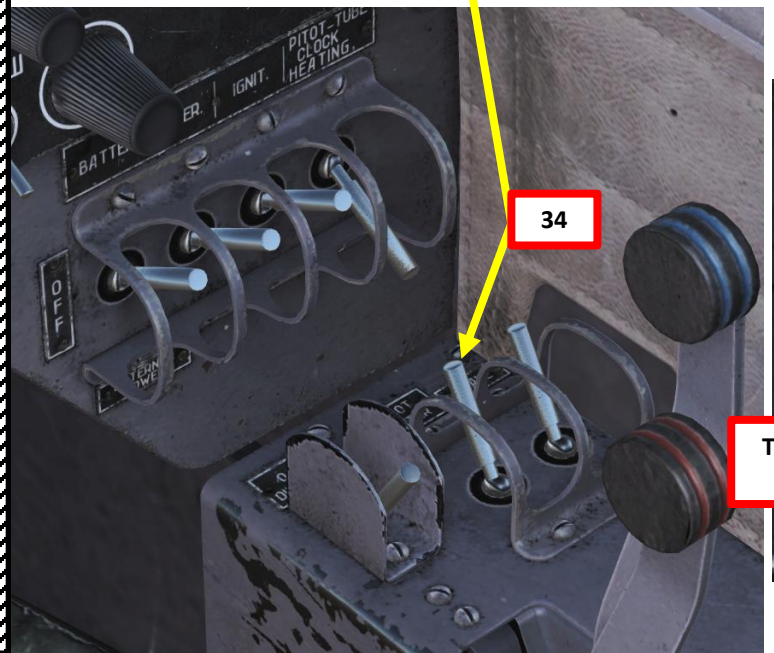


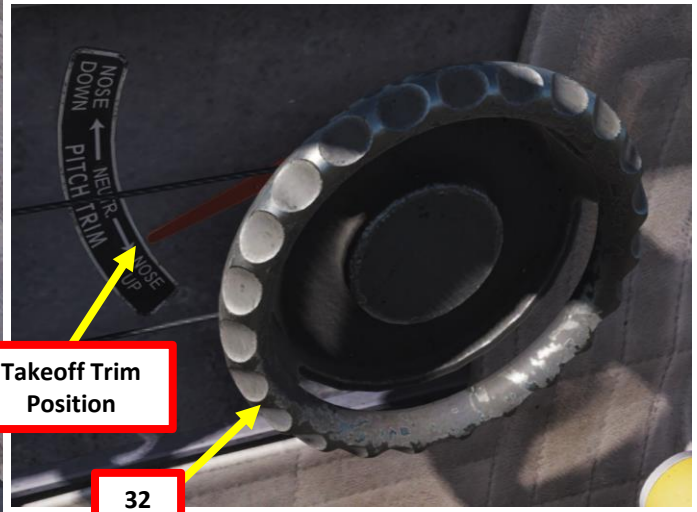


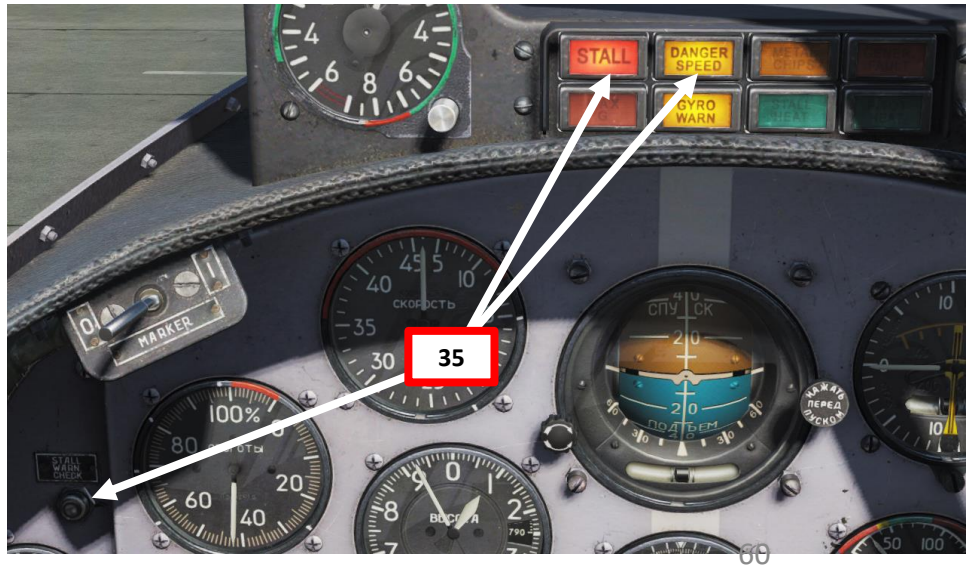
COMPLETE PRE-FLIGHT

32. Set Elevator Trim to Takeoff Trim Position (1/3 down)
33. Test Pitot Heat Switch. Confirm that PITOT HEAT indication illuminates when the switch is ON.
34. Test Stall Warning System AoA Vane Heat Switch. Confirm that STALL HEAT indication illuminates when the switch is ON.
35. Test Stall Warning using the STALL WARN CHECK Button. Confirm that STALL and DANGER SPEED indications illuminate when the switch is pressed.
36. Test Fuel Indicator. Confirm that fuel indication displays 25 litres when test switch is held.









ENGINE RUN-UP CHECKS

The engine run-up is basically a series of checks to make sure that every engine component is behaving as expected in relevant engine regimes.

A) MAX CONTINUOUS POWER SETTING CHECKS

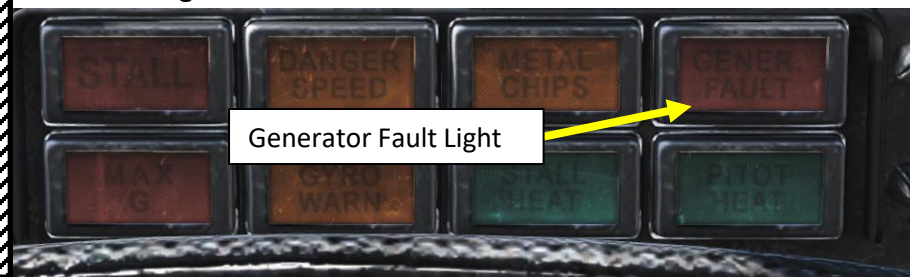
1. Open up Oil Radiator and Engine Cowling Shutters (Cooling Gills) setting the Oil Rad and Gill levers Forward (OPEN).
2. After engine is warmed up, set Propeller Lever to Full Forward (Fine Pitch).
3. Set Throttle to maintain approx. 70 % RPM.
4. Verify that engine parameters are stabilized as per the Max Continuous Power Settings card.
5. Set Propeller Lever to Full Aft (Coarse Pitch) and verify that RPM drops down to 52-54 % RPM.
6. Set Propeller Lever to Full Forward (Fine Pitch) and verify that RPM rises back to 70 % RPM.

B) MAGNETO & SPARK PLUG CHECKS

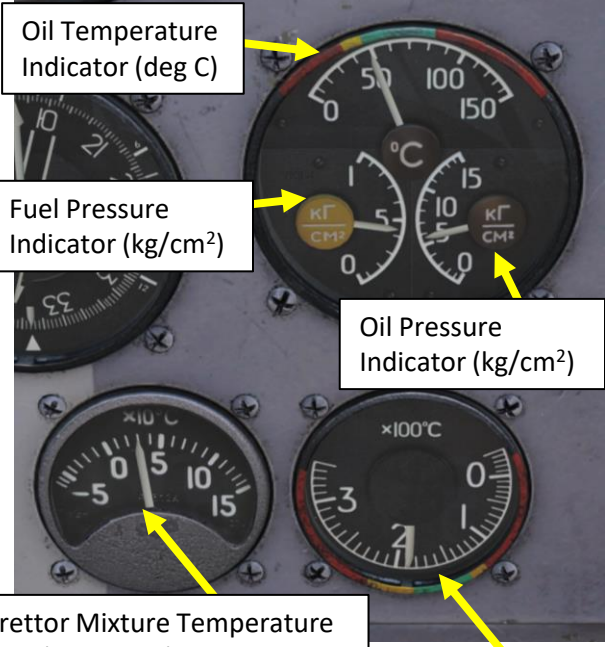
1. Set Propeller Lever to Full Forward (Fine Pitch) and set throttle between 64 and 70 % RPM
2. Set Magneto Switch to 1 for 15 to 20 seconds. Verify that RPM drop does not exceed 3 % RPM.
3. Set Magneto Switch back to 1+2.

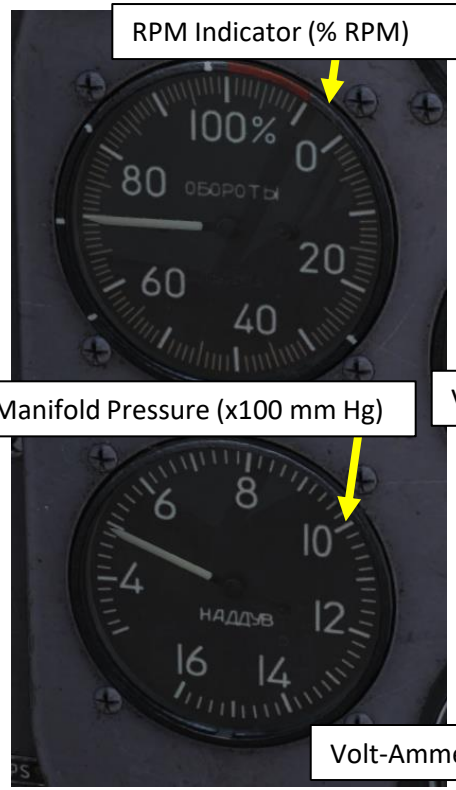
C) GENERATOR CHECKS

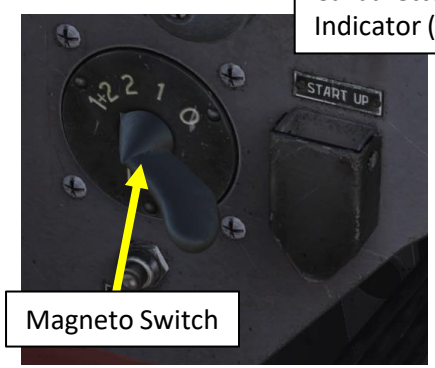
1. Set throttle to maintain 57-58 % RPM
2. Press Volt-ammeter button and verify that voltage is 27-29 V.
3. Verify that GENERATOR FAULT red signal lamp is extinguished.

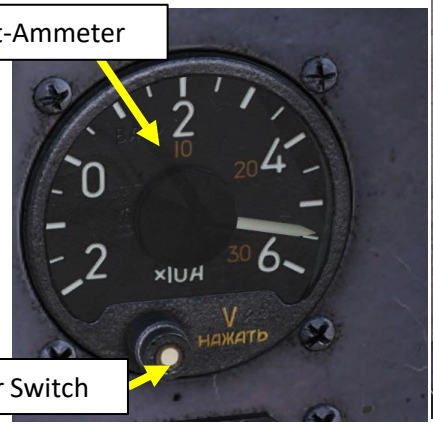


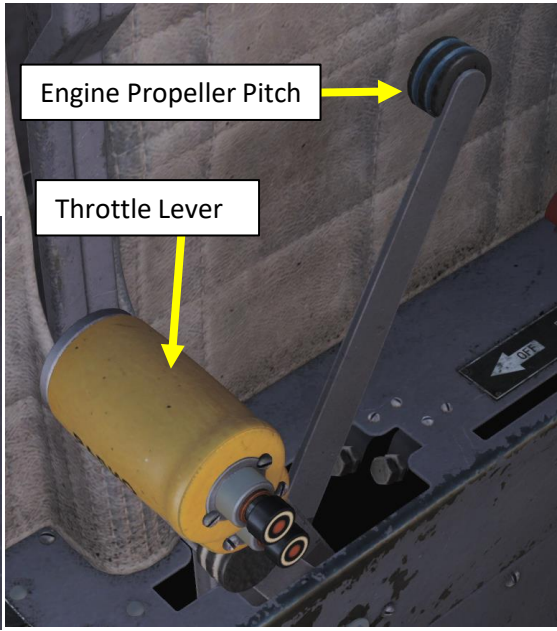
MAX CONTINUOUS POWER SETTING CARD	
Engine RPM (%)	70
Manifold Pressure (mm Hg)	75 + 15 (excessive) above Barometric Pressure (760 mm @ ISA conditions)
Fuel Pressure (kg/cm^2)	0.2 to 0.5
Oil Pressure (kg/cm^2)	4 to 6
CHT (Cylinder Head Temperature) (deg C)	120 to 220
Carburettor Inlet Air Temperature (deg C)	+10 to +45
Engine Inlet Oil Temperature (deg C)	40 to 75











ENGINE RUN-UP CHECKS

D) TAKEOFF POWER SETTING CHECKS

1. Set Propeller Lever to Full Forward (Fine Pitch) and set throttle at about 99 % RPM
2. Verify that engine parameters are stabilized as per the Takeoff Power Settings card.

E) IDLE POWER SETTING CHECKS

1. Set Propeller Lever to Full Forward (Fine Pitch) and set throttle to IDLE (Fully Aft)
2. Verify that engine parameters are stabilized as per the Idle Power Settings card.

F) PROPELLER GOVERNING CHECKS

1. Exercise propeller through its whole range of motion twice using the Propeller Lever
2. Set Propeller Lever to Full Forward (Fine Pitch)
3. Set Throttle to maintain approx. 70 % RPM
4. Move throttle smoothly forward and backward (not to extreme positions) and verify that RPM is maintained.

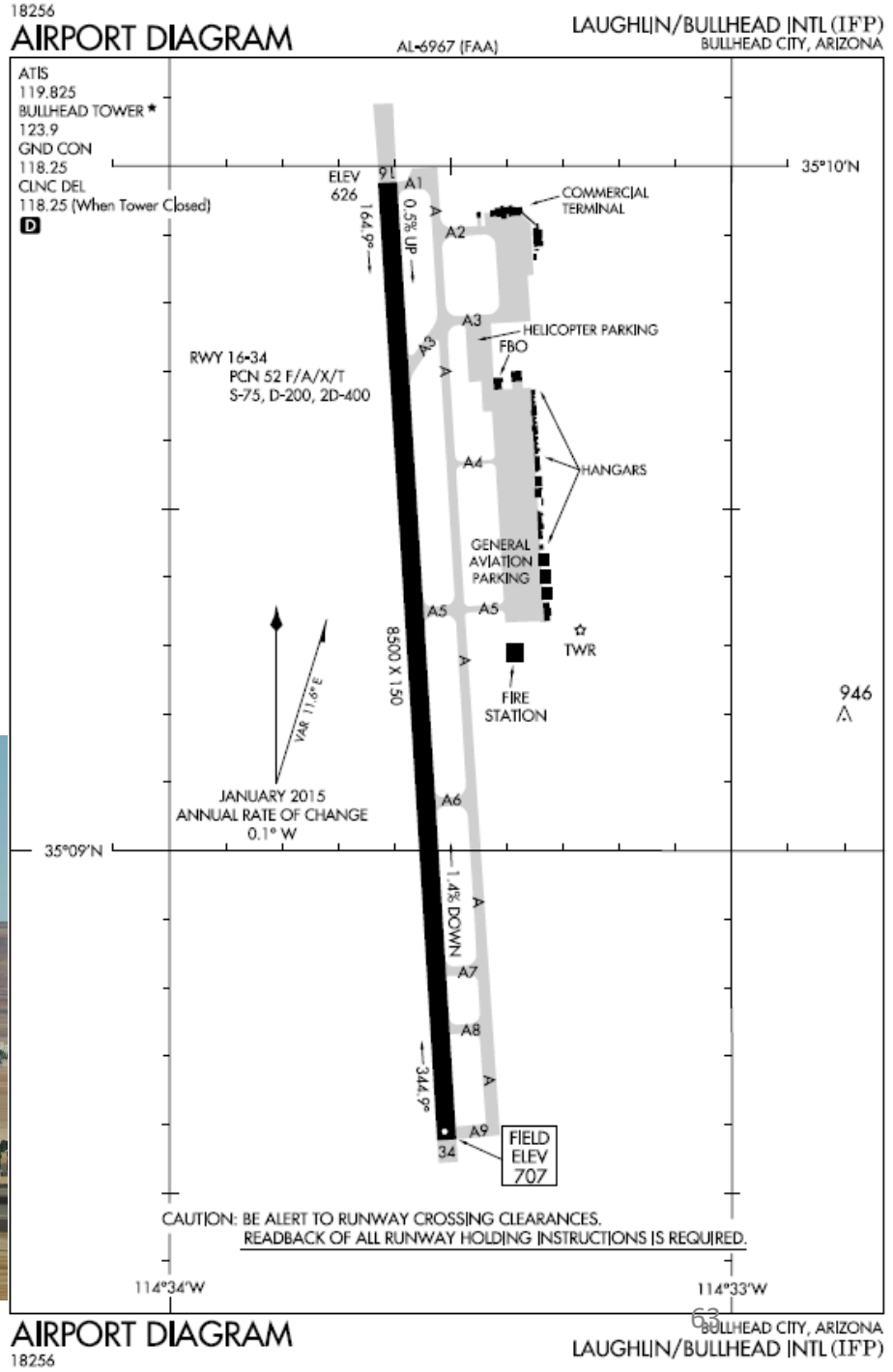
Start taxiing when engine is warmed up by releasing the Parking Brake (press on the Brake Lever to unlatch the brakes).

TAKEOFF POWER SETTING CARD	
Engine RPM (%)	99 + 1
Manifold Pressure (mm Hg)	125 + 15 (excessive) mm above Barometric Pressure (760 mm @ ISA conditions)
Fuel Pressure (kg/cm^2)	0.2 to 0.5
Oil Pressure (kg/cm^2)	4 to 6
CHT (Cylinder Head Temperature) (deg C)	120 to 220
Carburettor Inlet Air Temperature (deg C)	+10 to +45
Engine Inlet Oil Temperature (deg C)	40 to 75

IDLE POWER SETTINGS CARD	
Engine RPM (%)	26
Manifold Pressure (mm Hg)	IDLE (Throttle fully back)
Fuel Pressure (kg/cm^2)	Not less than 0.15
Oil Pressure (kg/cm^2)	Not less than 1.0
CHT (Cylinder Head Temperature) (deg C)	120 to 220
Carburettor Inlet Air Temperature (deg C)	+10 to +45
Engine Inlet Oil Temperature (deg C)	40 to 75

In this example, we will takeoff from the Laughlin/Bullhead International Airport. In real life, in a **controlled airport** like Bullhead we would use the Bullhead Ground radio frequency (118.25) to request taxi instructions to the active runway, then contact Bullhead Tower (123.9) to request a takeoff clearance and departure instructions. Typically, the runway in use (active) is the one that allows a takeoff with a head wind, which helps minimizing takeoff runway length and landing distance. In an **uncontrolled airport**, you can check the windsock direction and determine the direction of takeoff from there (or ask nearby Bullhead Traffic on the UNICOM (Universal Communication) frequency, which is generally 123.000 in North America or published in relevant sectional or terminal area charts).

As an example, for wind conditions of 10 kts with a heading of 010, we will taxi from Apron 2, follow Taxiway Alpha, then takeoff using Runway 16 (heading 160).



TAXI PROCEDURE

In this example, we will takeoff from Laughlin

a) Ensure engine is warmed up and that parking brake is released.
b) Set throttle to 40 % RPM and check brake effectiveness.
c) Typically, in a controlled airfield you would request permission to taxi on the ground frequency.
d) Once taxi instructions are received, you would have to read back these instructions and end transmission with your callsign.
e) Release brake lever and start taxiing.
f) To execute a turn, press and hold the wheel brake lever while simultaneously giving rudder input in the desired direction. Yak-52 pilots generally try to use brakes sparingly in order to preserve available air pressure. Think of the pneumatic pressure like pressurized air in the gas canister of a paintball gun: once you run out of pressure, you're in trouble. What kind of trouble? Well, try landing in one piece with no brakes (that are pneumatically actuated).
g) When lined up on the runway, verify that canopy is closed. This step is optional.

Note: *During taxi, pilots generally keep their throttle just forward enough for the generator to kick in (generator light extinguished). This will give a high taxi speed, which has the advantage that the pilot does not have to use brakes as much to turn since the rudder is more effective at high taxi speeds.*

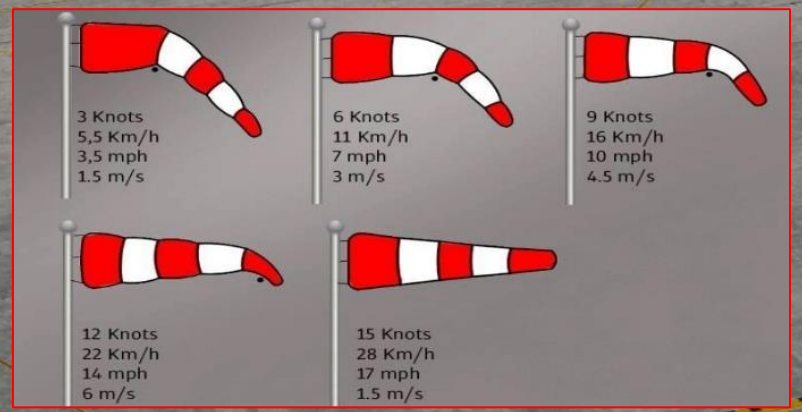
Taxi Request Example

- (YOU) Bullhead Ground, this is Yak-52 X-Ray Romeo Oscar on Apron 2. Requesting Taxi.
- (GRD) X-Ray Romeo Oscar, Bullhead Ground. Taxi to Holding Point Runway 16 via Alpha.
- (YOU) Taxi – Holding Point Runway 16 via Alpha, X-Ray Romeo Oscar.

Runway Threshold

Holding Point

Windsock



Runway

Taxiway

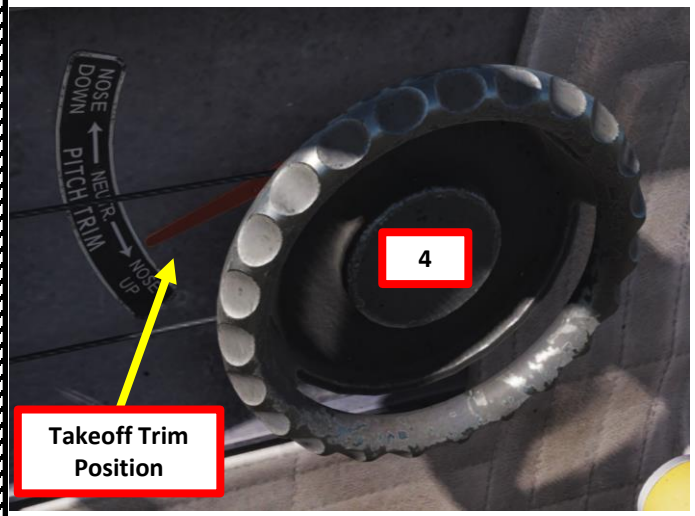
TAKEOFF PROCEDURE

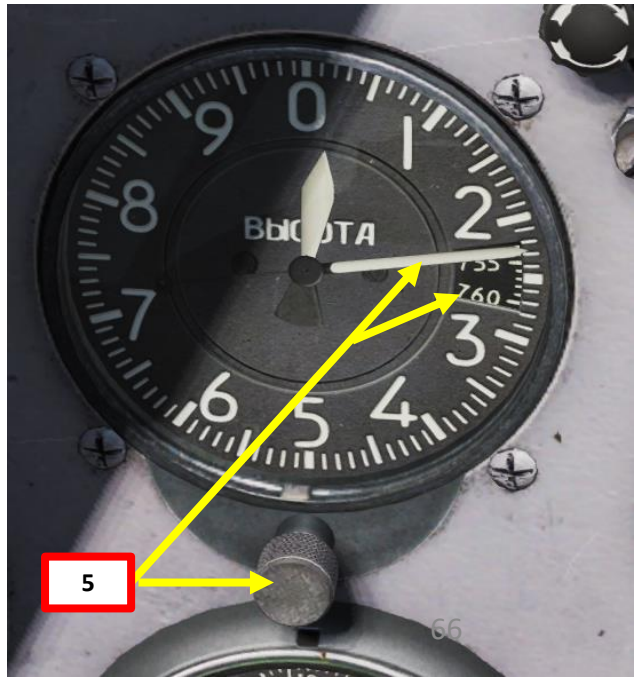
1) Ensure Propeller Lever is set to Full Forward (Fine Pitch)
2) Verify flaps lever is in NEUTRAL and flaps position is UP
3) Verify engine parameters are within safe operation range (see card).
4) Verify that Elevator Takeoff Trim is set to Takeoff Position
5) Adjust Altimeter Setting so that the altimeter indicates the airport elevation (212 meters for Bullhead Airport).
6) Typically, in a controlled airfield you would request permission to takeoff on the Tower frequency
7) Once departure permission has been granted, you would have to read back these instructions and end transmission with your callsign.
8) Check that no aircraft is landing and line up on the runway.
9) Once lined up on the runway, hold brakes and throttle up to 70 % to burn off excess oil on the engine spark plugs.

Departure Request Example

- (YOU) Bullhead Tower, this is Yak-52 X-Ray Romeo Oscar on Holding Point Runway 16. Ready for departure.
- (TWR) X-Ray Romeo Oscar, Bullhead Tower. Hold Short of Runway 16.
- (YOU) Holding Short of Runway 16. X-Ray Romeo Oscar.
- (TWR) X-Ray Romeo Oscar, Bullhead Tower. Cleared for departure when ready, Runway 16, Wind 010 at 10 kts.
- (YOU) Cleared for Departure, Runway 16, X-Ray Romeo Oscar.

TAKEOFF POWER SETTING CARD	
Fuel Pressure (kg/cm^2)	0.2 to 0.5
Oil Pressure (kg/cm^2)	4 to 6
CHT (Cylinder Head Temperature) (deg C)	120 to 220
Engine Inlet Oil Temperature (deg C)	40 to 75

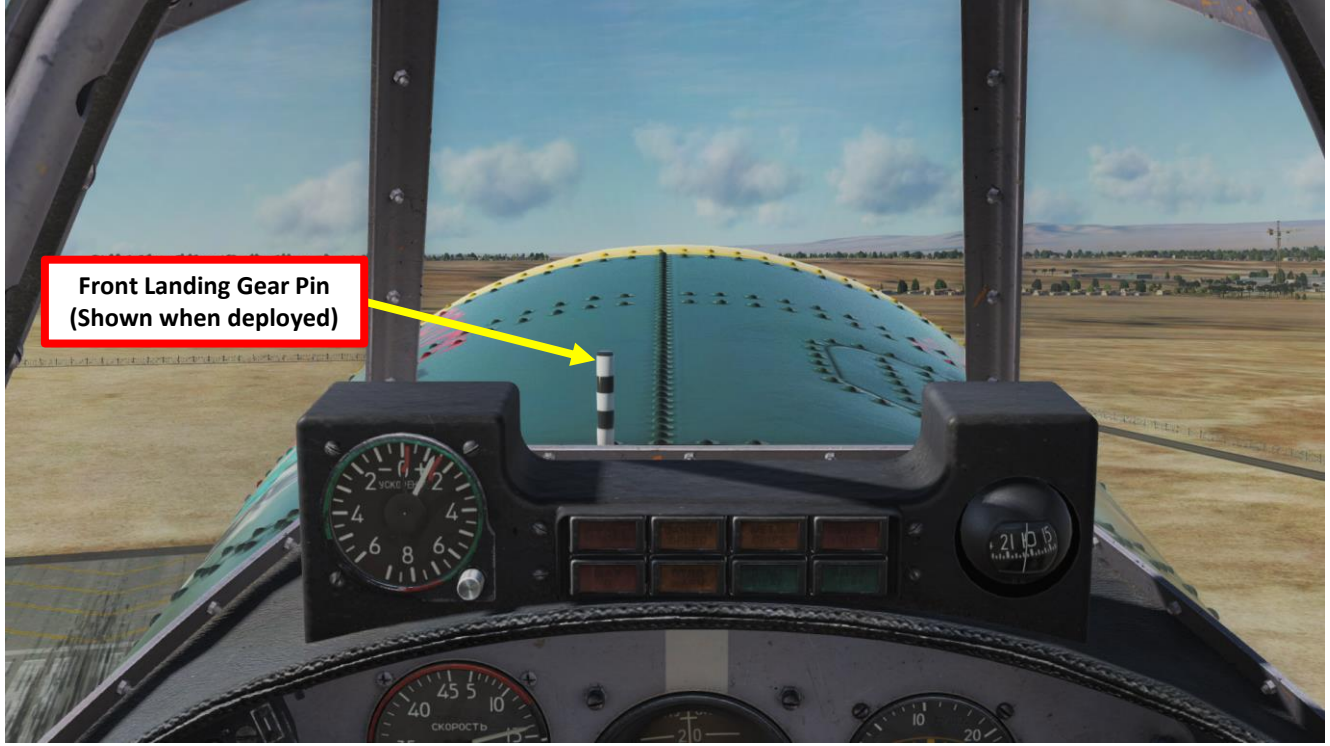




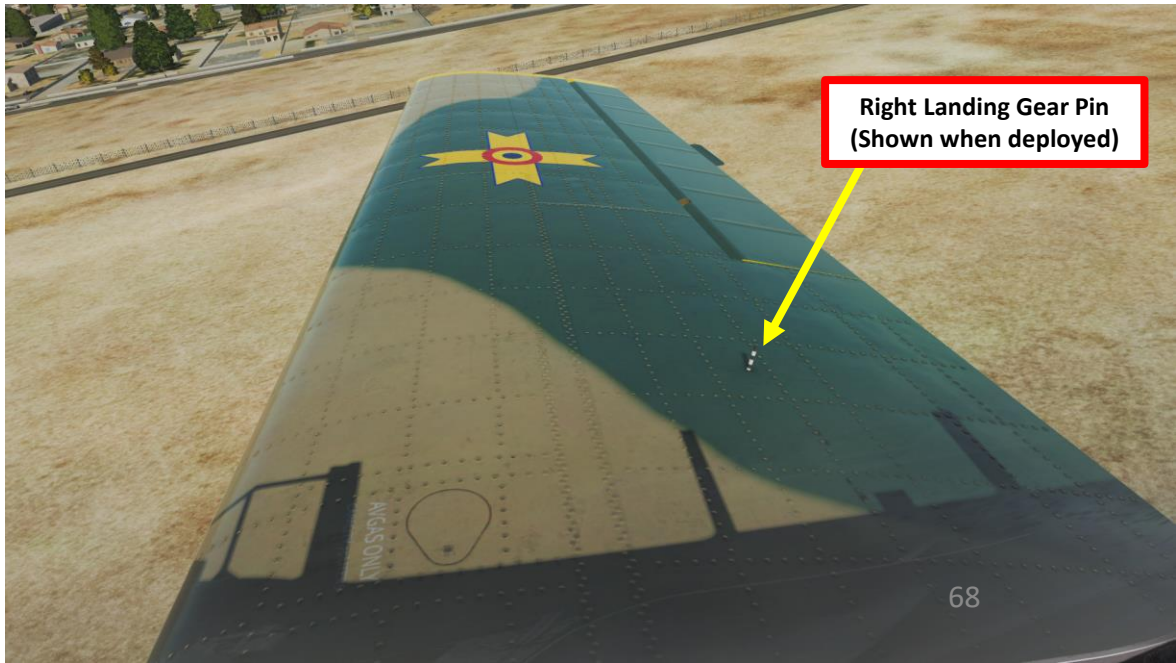
TAKEOFF PROCEDURE

10) Set stick to Neutral position, then gradually throttle up 100 % RPM. Compensate engine torque (yawing to the right) with left rudder input. The slower your increase the throttle, the better control you will have over the acceleration and engine torque of the aircraft.
11) Once you reach 90 km/h, smoothly pull up on the stick, raising front wheel to takeoff position.
12) Rotate when reaching 120 km/h.
13) Raise Landing Gear by drawing the gear control catch aside and setting Landing Gear Lever UP.
14) Confirm that GEAR UP red lights illuminate
15) Check gears pins and confirm that they are all DOWN
16) Set Propeller Pitch Lever to 82 % RPM once reaching 1000 ft altitude.
17) Start initial climb at 170 km/h.
18) Trim the aircraft until no pressure is felt in the stick.

Tutorial (Bagpipe haters beware!):
https://youtu.be/w4rN6O51gCI


Front Landing Gear Pin
(Shown when deployed)

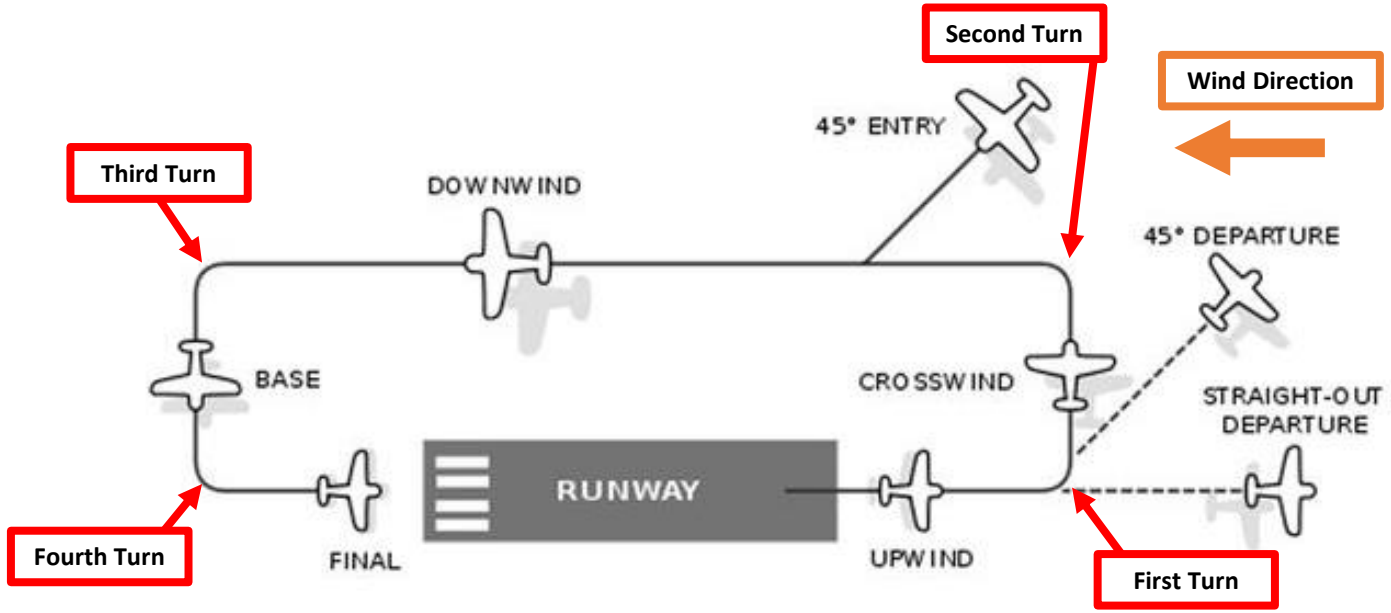

Left Landing Gear Pin
(Shown when deployed)

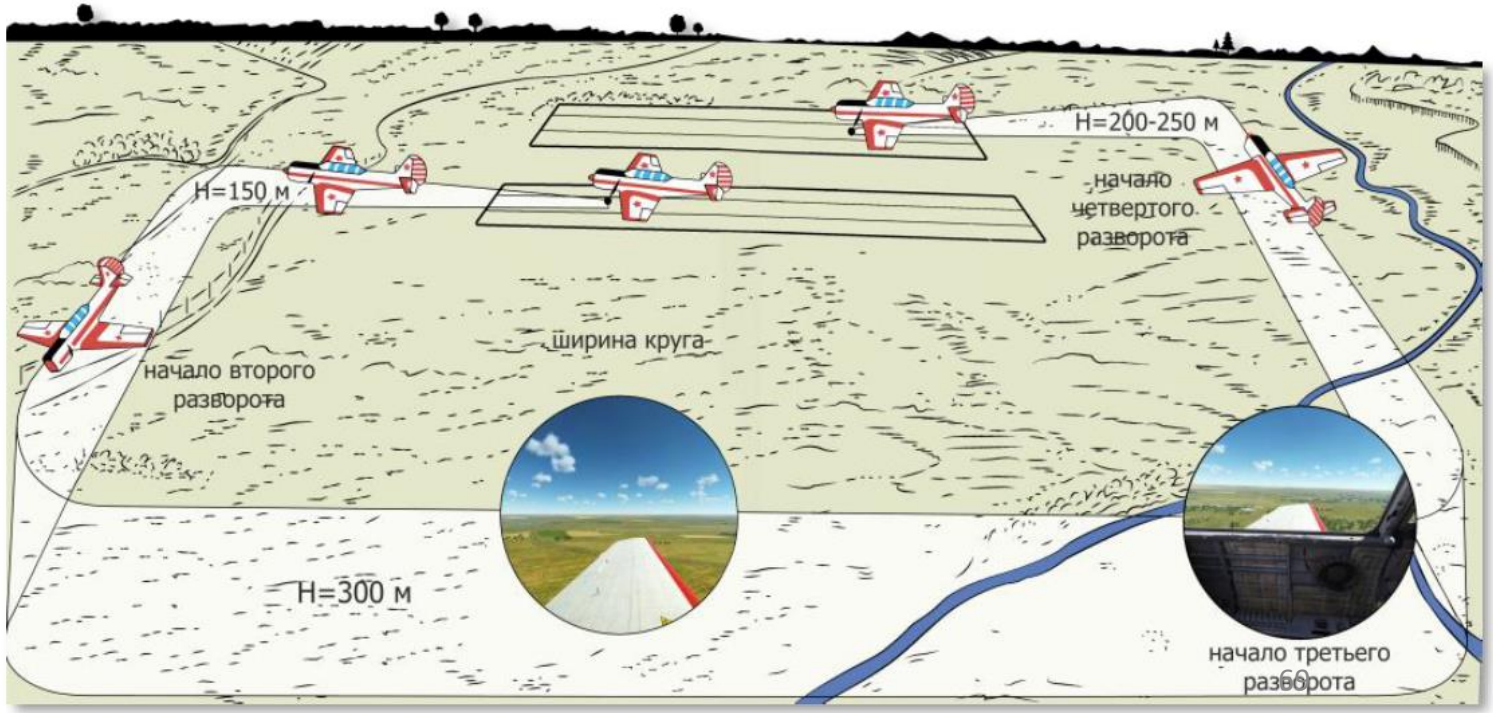

Right Landing Gear Pin
(Shown when deployed)

CIRCUIT

The standard circuit direction is to the left. A circuit is divided in five different legs:

- Takeoff is on the **Upwind** leg (you are flying "upstream" of the head wind flow)
- A first left-hand turn is then performed until reaching the **Crosswind** leg. 30 deg banking angle, 150 m altitude AGL (Above Ground Level), steady speed of 170 km/h, nose pointed level on the horizon while coordinated turn is maintained with stick and rudder.
- Airspeed (170 km/h) should be maintained during the Crosswind leg
- A second left-hand turn is performed until reaching the **Downwind** leg (you are flying "downstream" of the head wind flow). 170 km/h airspeed is maintained during the climb. When reaching an altitude of 300 m AGL, level off and set throttle between 470-490 mm Hg with a propeller pitch lever set to 70 % RPM to maintain 180 km/h.
- Airspeed (180 km/h) should be maintained during the Downwind leg.
- While on downwind, deploy landing gear, trim the aircraft to stay level, call the Tower and request a landing clearance.
- A third left-hand turn is performed until reaching the **Base** leg. In the turn, adjust throttle to maintain altitude while leaving RPM set to 70 %.
- Airspeed (180 km/h) should be maintained during the Base leg. Base leg entry altitude is between 200 and 250 m.
- A fourth left-hand turn is performed until reaching the **Final** leg. Propeller Pitch lever is set fully forward (fine), bank angle is 30 deg, airspeed of 170 km/h is maintained and a rate of descent of 4-5 m/s is maintained. Enter the final leg at no less than 150 m altitude.
- On the **Final** leg, deploy flaps and maintain 160 km/h. Control your airspeed with aircraft pitch, not with the throttle.
- Flare-out is performed at 5-6 m by smoothly pulling back on the stick to level off and simultaneously reducing throttle to IDLE. Touchdown speed should be 115-120 km/h.





CIRCUIT RADIO CALLS

- *(TWR) X-Ray Romeo Oscar, Bullhead Tower. Enter left downwind, runway 16, report entering left downwind.*

Tower is basically telling you to report to them once you enter the left downwind leg for runway 16.

2

1

- *(YOU) Bullhead Tower, Yak-52 X-Ray Romeo Oscar, 10 miles south of Laughlin, inbound for landing.*

Note: In real life, you'll often hear « inbound with India » or other letters. This refers to the ATIS (Automatic Terminal Information Service) revision for the current weather conditions. In order to know your altimeter setting for landing, pilots can tune to an automatic broadcast that states weather conditions like wind, clouds, QFE, etc.

Initial Contact (5-10 miles from Airport)

3

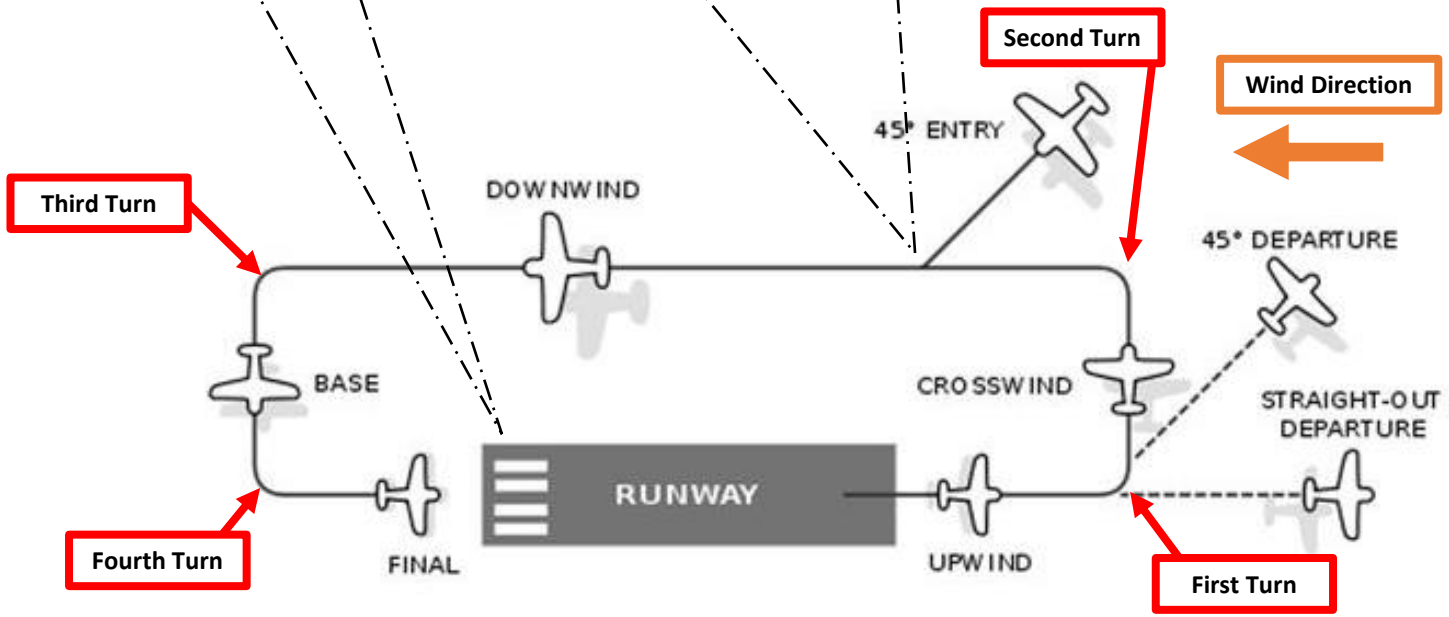
- *(YOU) X-Ray Romeo Oscar will report left downwind, runway 16. X-Ray Romeo Oscar.*

This is simply the readback of the instructions given by the Air Traffic Controller.

4

- *(YOU) Bullhead Tower, X-Ray Romeo Oscar, left downwind, runway 16. X-Ray Romeo Oscar.*

We're informing the tower we've just entered the left downwind leg (traffic circuit turns to the left).



CIRCUIT RADIO CALLS

- *(YOU) Bullhead Tower, X-Ray Romeo Oscar, cleared to land, runway 16, X-Ray Romeo Oscar.*

This is simply the readback of the instructions given by the Air Traffic Controller. We confirm that we have been given clearance to land on runway 16.

6

- *(TWR) X-Ray Romeo Oscar, Bullhead Tower. Cleared to land runway 16.*

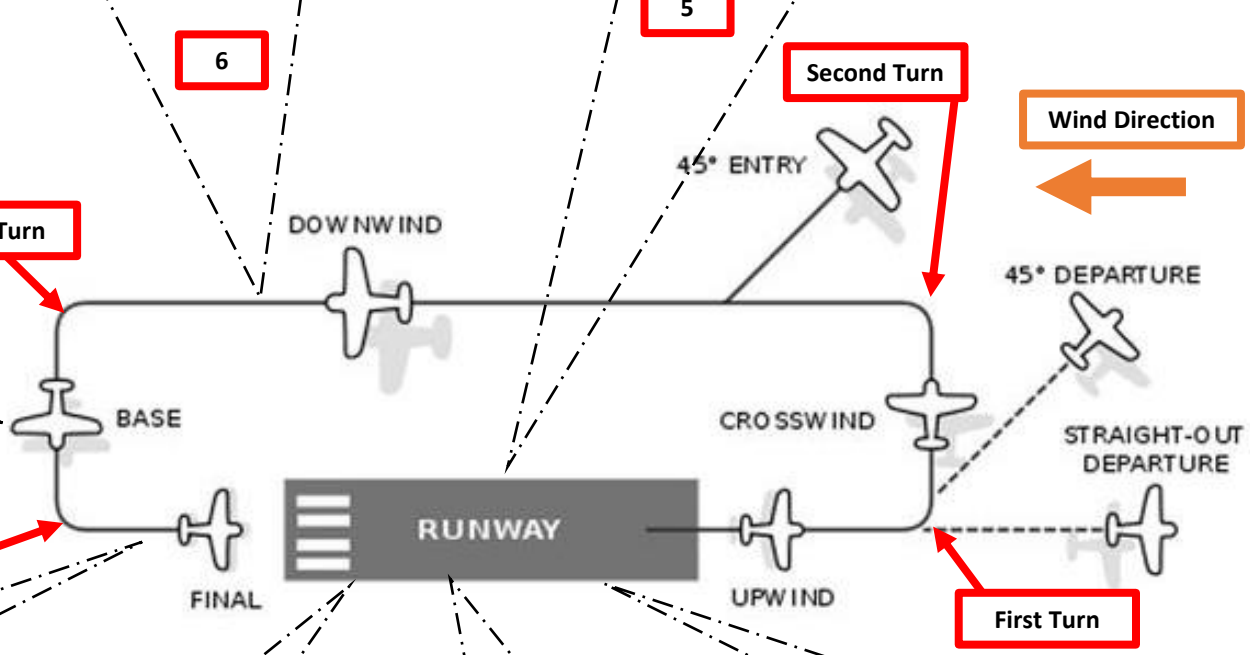
Tower is granting you clearance to land on runway 16.

5

- *(YOU) Bullhead Tower, X-Ray Romeo Oscar, left base for runway 16, X-Ray Romeo Oscar.*

We inform tower that we are on the left base. Some people do this call, others don't. It's up to your personal preference.

7



8

- *(YOU) Bullhead Tower, X-Ray Romeo Oscar, on final for runway 16. X-Ray Romeo Oscar.*

We're informing the tower we're in the final leg, landing on runway 16.

9

- *(TWR) X-Ray Romeo Oscar, turn left on Alpha, Contact Ground, 118.25, leaving runway.*

Tower tells us to turn left on the Alpha taxiway/exit, and then to contact Bullhead Ground on frequency 118.25 when leaving the runway.

10

- *(YOU) Left turn, next taxiway, contact Ground on 118.25. X-Ray Romeo Oscar.*

Readback of the ATC instructions.

11

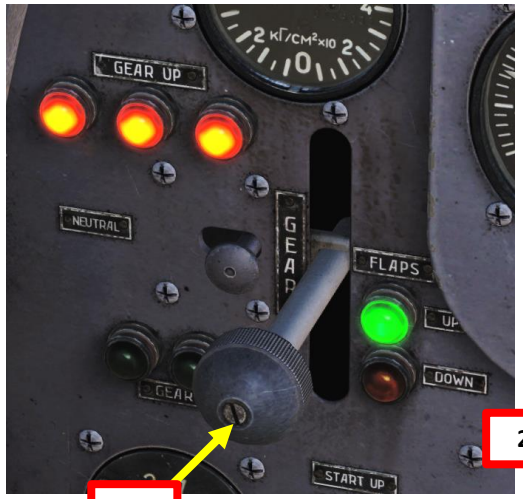
- *(YOU) Clear of the active, crossing Alpha, X-Ray Romeo Oscar.*

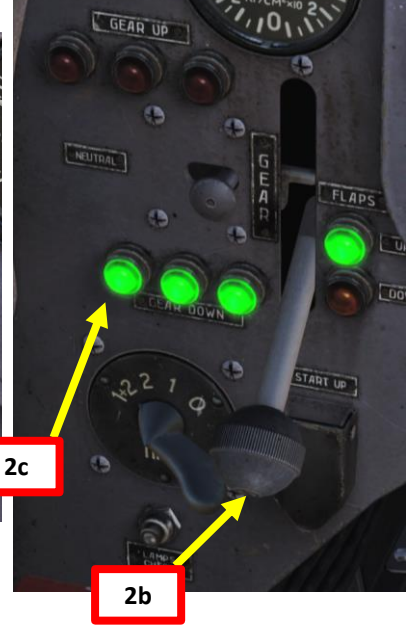
We're informing the tower we're clear of the active runway and we are crossing the Alpha taxiway.

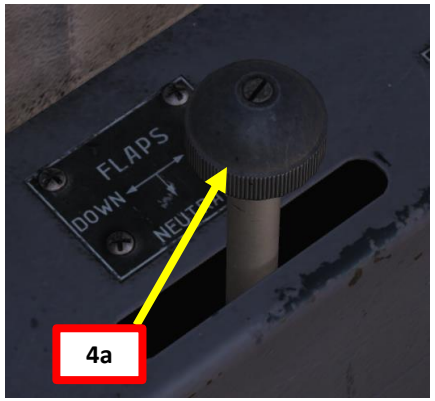
LANDING PROCEDURE

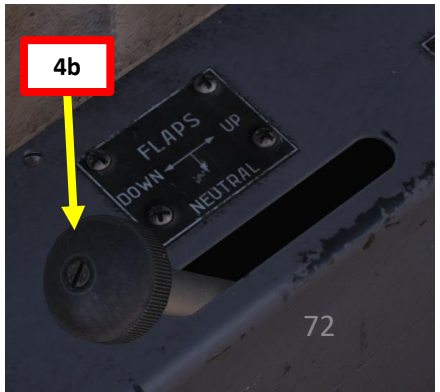
1) Airspeed (180 km/h) should be maintained during the Base leg. Base leg entry altitude is between 200 and 250 m.
2) Deploy Landing Gear by drawing the gear control catch aside and setting Landing Gear Lever DOWN.
3) When turning in on Final (30 deg bank), set propeller Pitch lever fully forward (fine). Maintain an airspeed of 170 km/h and a rate of descent of 4-5 m/s is maintained. Enter the final leg at no less than 150 m altitude.
4) On the Final leg, set flaps lever to DOWN (AFT).
5) Check landing gear pins and confirm that they are all UP
6) Maintain 160 km/h. Control your airspeed with the throttle and manage your altitude and glide slope with the aircraft pitch, which is what is taught in Russian flight schools.
7) Flare-out is performed at 5-6 m by smoothly pulling back on the stick to level off and simultaneously reducing throttle to IDLE. Touchdown speed should be 115-120 km/h.

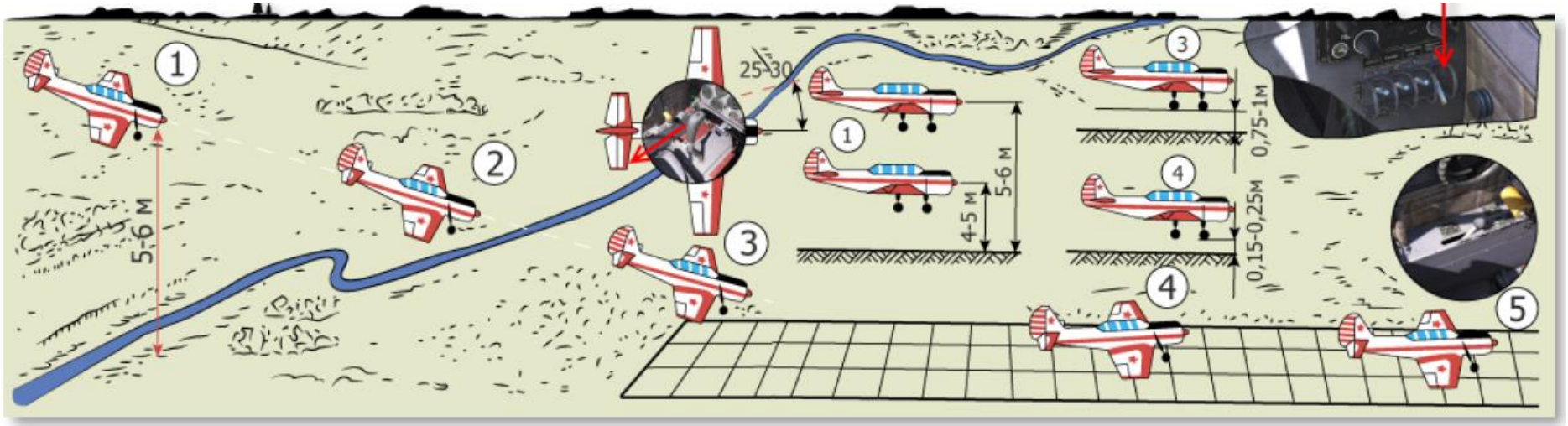
Tutorial (Bagpipe haters beware!):
https://youtu.be/w4rN6O51gCI











LANDING PROCEDURE

1) Airspeed (180 km/h) should be maintained during the Base leg. Base leg entry altitude is between 200 and 250 m.
2) Deploy Landing Gear by drawing the gear control catch aside and setting Landing Gear Lever DOWN.
3) When turning in on Final (30 deg bank), set propeller Pitch lever fully forward (fine). Maintain an airspeed of 170 km/h and a rate of descent of 4-5 m/s is maintained. Enter the final leg at no less than 150 m altitude.
4) On the Final leg, set flaps lever to DOWN (AFT).
5) Check landing gear pins and confirm that they are all UP
6) Maintain 160 km/h. Control your airspeed with the throttle and manage your altitude and glide slope with the aircraft pitch, which is what is taught in Russian flight schools.
7) Flare-out is performed at 5-6 m by smoothly pulling back on the stick to level off and simultaneously reducing throttle to IDLE. Touchdown speed should be 115-120 km/h.

Tutorial (Bagpipe haters beware!):
https://youtu.be/w4rN6O51gCI

PART 6 – CIRCUIT & LANDING

ENGINE SHUTDOWN

Note: It is forbidden to perform an engine shutdown while operating at a high power setting.

1. Set the parking brake ON
2. Set throttle to IDLE (fully aft)
3. Turn off radio station, radio compass, cockpit communication system, and set the Attitude Indicator OFF.
4. Cool down the engine if necessary. Cylinder head temperature should be between 140 and 160 deg C. Avoid prolonged engine running at low RPM.
5. Burn through the spark plug oil. (see note below)
6. Turn magneto switch OFF (0 position)
7. Turn all other cockpit switches OFF.

NOTE ABOUT SPARK PLUG OIL:

Radial engines are notorious for oil leaks mostly because there are so many more places for potential leaks than on a horizontally opposed engine. Radial engines generally use a dry sump (oil storage area), meaning the oil is in a separate tank from the crankcase.

When the engine sits, the oil that is coating the inside of the crankcase leaks down into the lower cylinders. This is why you see all this smoke during an engine start: the excess oil in the cylinders is burned off. That's also the reason for hand cranking it before starting: to clear out excess oil and check that excess oil is not creating a hydraulic lock in a cylinder. This is also part of the reason they appear to start hard/sputter at first. Oil fouls the plugs and it takes a few pops to burn it off. This is why you let the engine burn off the excess oil on the spark plugs before shutting down the engine.

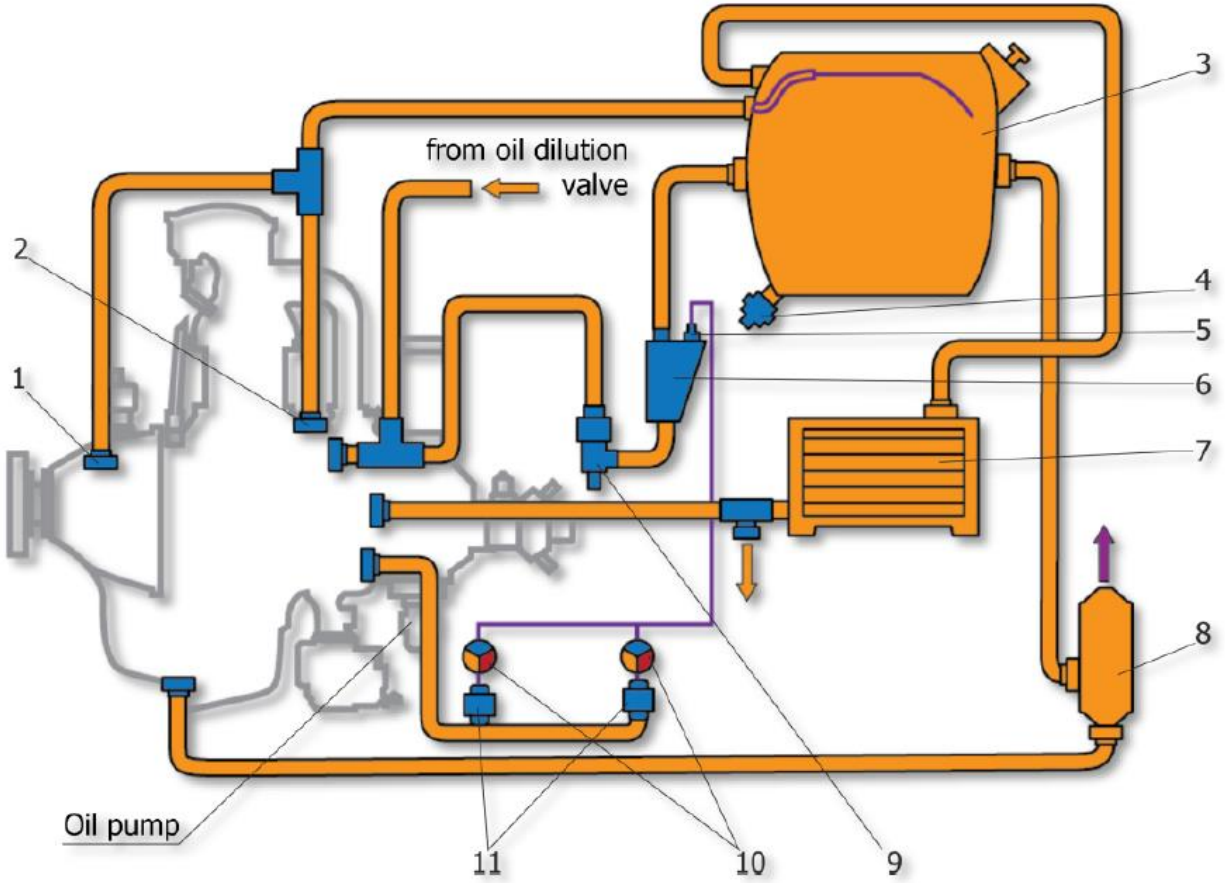


Figure 8. **Schematic diagram of the oil system.**

1 - front engine breather; 2 - rear engine breather; 3 - oil tank; 4 - oil tank drain valve; 5 - P-1 temperature receiver; 6 - oil tank; 7 - air-oil radiator; 8 - breather tank; 9 - oil filter; 10 - gauges from the EMR-3K set; 11 - P-15B oil pressure receiver.

VEDENEYEV M-14P ENGINE

The Yak-52 is powered by the Vedeneyev M14P, a Russian nine-cylinder, four-stroke, air-cooled, petrol-powered radial engine. Producing 360 hp (268 kW), its design dates from the 1940s, and is itself a development of the Ivchenko AI-14 engine. The engine has been used extensively by the Yakovlev and Sukhoi Design Bureaus.

The engine's intake system uses a gear driven supercharger and an automatic-mixture type carburettor. Power is transmitted to the propeller via a reduction gearbox. In addition to the carburetor, the engine has a speed governor, two magnetos, mechanical fuel pump, generator, and an oil pump. It is started pneumatically, and remains fully operational during inverted flight. Unlike most American piston-type aero-engines, which turn to the right (clockwise) when viewed from the cockpit, the M14P rotates to the left (counter-clockwise), like most British-designed radials of the World War II era.

The pilot can still monitor engine RPM, manifold pressure, carburettor mixture temperature, fuel pressure, oil pressure, oil temperature and cylinder head temperature. Each parameter has specific limitations that you should be aware of **AT ALL TIMES**. The engine limitations are listed in the table on the next page.

If engine overheats, you can:

1. Enter a dive to increase airspeed and airflow to the engine intake.
2. Reduce throttle and RPM
3. Decrease rate of climb
4. Set the oil radiator and engine cowling shutters (cooling gills) levers to OPEN

CHECK YOUR ENGINE TEMPERATURES EVERY 30 SECONDS OR SO. IT WILL SAVE YOUR LIFE.

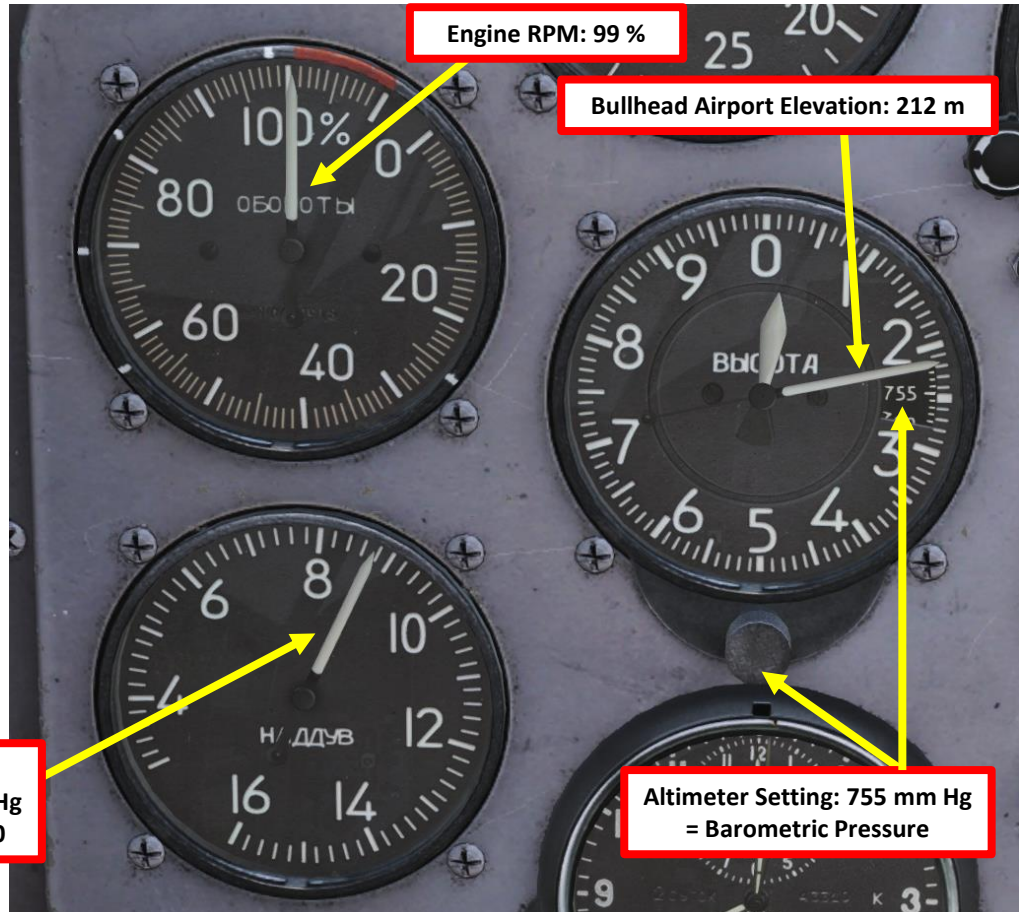
ENGINE MODES OF OPERATION

Power Setting	RPM (%)	Manifold Pressure (mm Hg)	CHT Cylinder Head Temp (deg C)	Engine Inlet Oil Temp (deg C)
Takeoff	99	125 above Barometric Pressure (760 mm @ ISA conditions)	120 – 220	40 – 75
Max Continuous Power Nominal Power Setting #1 (max permissible CHT is 240 deg C, up to 15 min)	82	95 above Barometric Pressure (760 mm @ ISA conditions)	120 – 220	40 – 75
Nominal Power Setting #2 (max permissible oil temp is 85 deg C, up to 15 min)	70	75 above Barometric Pressure (760 mm @ ISA conditions)	120 – 220	40 – 75
Cruising Power Setting #1 (max permissible CHT is 240 deg C, up to 15 min)	64	735	120 – 220	40 – 75
Cruising Power Setting #2 (max permissible oil temp is 85 deg C, up to 15 min	59	670	120 – 220	40 – 75
Idle	Not exceeding 26	-	-	-

NOTE ABOUT POWER SETTINGS:

Power settings in the Yak-52 are sometimes referred for Takeoff and Max Continuous Power settings as offsets above the barometric pressure. The way to calculate the barometric pressure while on the ground is not complicated: adjust the altimeter setting knob to the airport elevation, and read the resulting barometric pressure on the altimeter.

As an example, for Takeoff Power the manifold pressure is 125 mm above barometric pressure. If the barometric pressure is 755 mm Hg, the manifold pressure for Takeoff Power would be 755 + 125 = 880 mm Hg



Oil Temperature Limits (Engine Inlet)

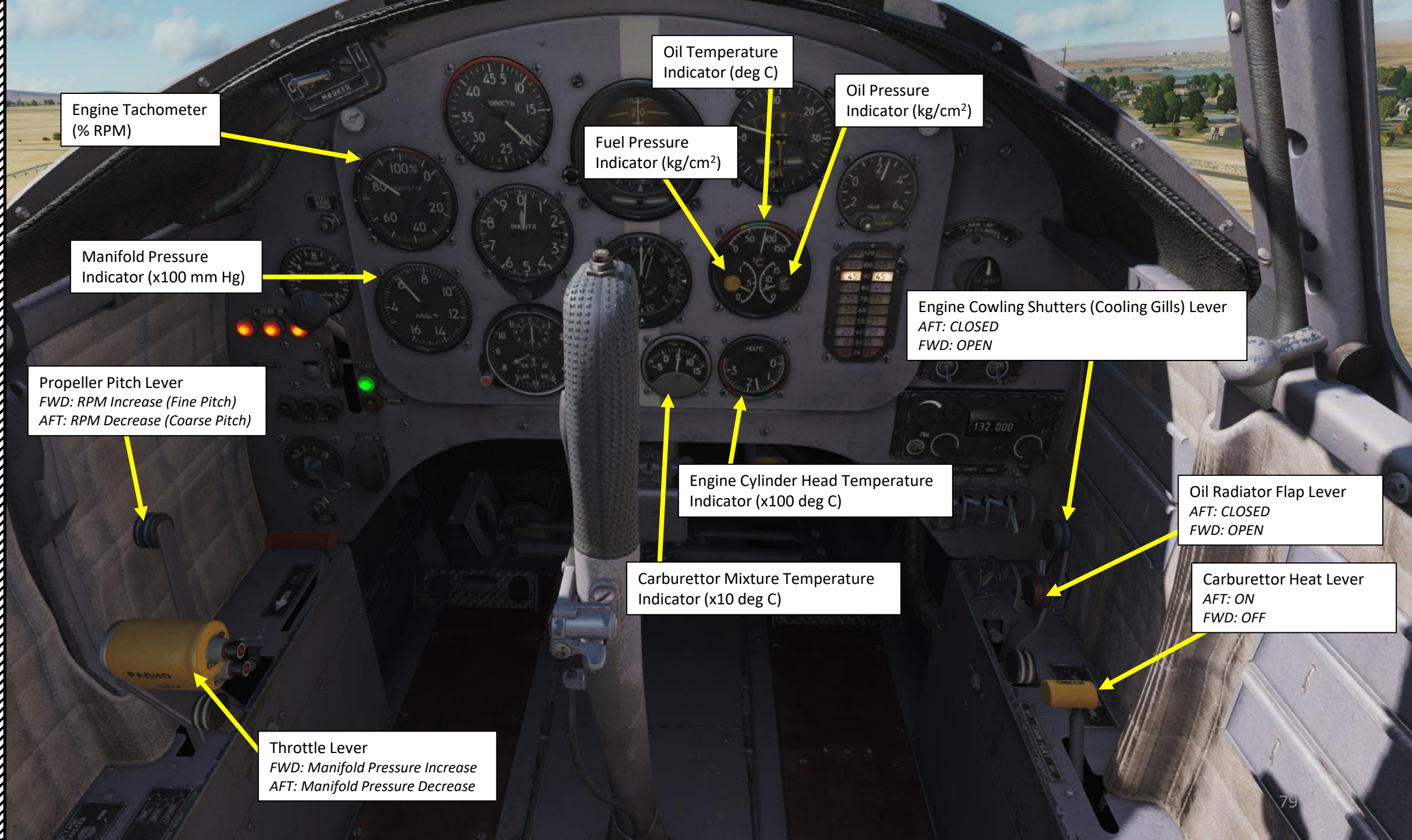
Limit	Temperature (deg C)
Minimum Permissible	40
Recommended	50-65
Maximum permissible on prolonged engine operation	75
Maximum permissible for no longer than 15 min of continuous operation	85

Cylinder Head Temperature Limits (CHT)

Limit	Temperature (deg C)
Recommended	140-190
Minimum allowable for normal engine operation	120
Maximum permissible on prolonged engine operation	220
Maximum allowable for takeoff and climb modes no longer than 15 min and no more than 5 % from engine lifespan	240

Fuel Consumption Data

Mode of Flight	Fuel consumption (L)	Time (min)	Distance covered (km)
Recommended	2	5	-
Minimum allowable for normal engine operation	3	2	3
Maximum permissible on prolonged engine operation	0.5	1	2.5
Maximum allowable for takeoff and climb modes no longer than 15 min and no more than 5 % from engine lifespan	4	5	-


Engine Tachometer (% RPM)
Oil Temperature Indicator (deg C)
Oil Pressure Indicator (kg/cm²)
Fuel Pressure Indicator (kg/cm²)
Manifold Pressure Indicator (x100 mm Hg)
Engine Cowling Shutters (Cooling Gills) Lever
AFT: CLOSED
FWD: OPEN
Propeller Pitch Lever
FWD: RPM Increase (Fine Pitch)
AFT: RPM Decrease (Coarse Pitch)
Engine Cylinder Head Temperature Indicator (x100 deg C)
Oil Radiator Flap Lever
AFT: CLOSED
FWD: OPEN
Carburettor Mixture Temperature Indicator (x10 deg C)
Carburettor Heat Lever
AFT: ON
FWD: OFF
Throttle Lever
FWD: Manifold Pressure Increase
AFT: Manifold Pressure Decrease

EMERGENCY PROCEDURES

Engine Failure In-Flight

- Manoeuver the aircraft into a glide
- Retract undercarriage
- Shut off the fuel emergency shutoff cock
- Switch off magnetos, aircraft battery & ignition
- Open canopy

Engine Failure During Inverted Flight

- Execute a 180-deg roll and manoeuver the aircraft back into level flight
- Set a glide speed of 170-180 km/h
- Set throttle to approx. 1/3 of its full range
- Turn the handle of the priming pump to « Pipeline Fill » and pump up the fuel to a pressure of 0.1-0.2 kg/cm^2

Emergency Landing with a Dead Engine

- With a roll of 45 deg, turn towards the nearest airfield
- Glide range is defined as 7 times your current altitude
- Set an indicated airspeed of 160 km/h
- Shut off the fuel cock, switch off magetos, aircraft battery and ignition
- Land the aircraft

Fuel Pressure Drop

- Disruptions in the engine operation, accompanied by a drop in the engine's crankshaft speed, a drop in manifold pressure, and engine shaking indicate a drop in the aircraft's fuel pressure
- Turn the handle of the priming pump to the « Pipeline Fill » position and pump fuel into the fuel system while monitoring the pressure on the pressure gauge
- Abort the flight and immediately land on the aircraft's home or secondary airfield

Engine Shaking

- In all cases (with the exception of a drop in fuel pressure), pull the throttle all the way back, then pull back on the stick to manoeuver the aircraft into a glide, setting the required flight speed
- If the above preocedure eliminates the shaking, smoothly move the throttle forward and set the engine operating mode required for level flight
- If shaking does not stop after changing the engine operating mode, pilot must then inrease engine speed to 70 % and and set carburettor heat lever ON (AFT) to melt ice in the carburettor inlet
- If shaking does not stop after this, use the throttle and the propeller pitch lever to minimize the intensity of the engine shaking, then, using these settings, land back at the airfield

Engine Fire

- Shut off the fuel cock
- Turn off magneto, ignition and generator switches.
- Manoeuver the aircraft to a glide and if necessary apply slip to break up the flames
- Perform an emergency landing

EMERGENCY PROCEDURES

Propeller Overspeeding

- Mild engine shaking, increase in engine crankshaft speed or a sharp change in the sound of the operational engine may indicate a propeler overspeed
- During the takeoff roll, abort takeoff and taxi back to the aircraft parking lot for troubleshooting, but only if the aircraft is able to safely taxi back to its parking space
- After liftoff, increase propeller pitch by small movements on the propeller pitch controller and continue the takeoff. Retract undercarriage at an altitude of 15-20 m, proceed to perform a normal circular flight, then land at the airfield.
- If propeller overspeeding occurs during a glide, completely remove engine manifold pressure (boost) by throttle back and increase propeller pitch.

Mechanism

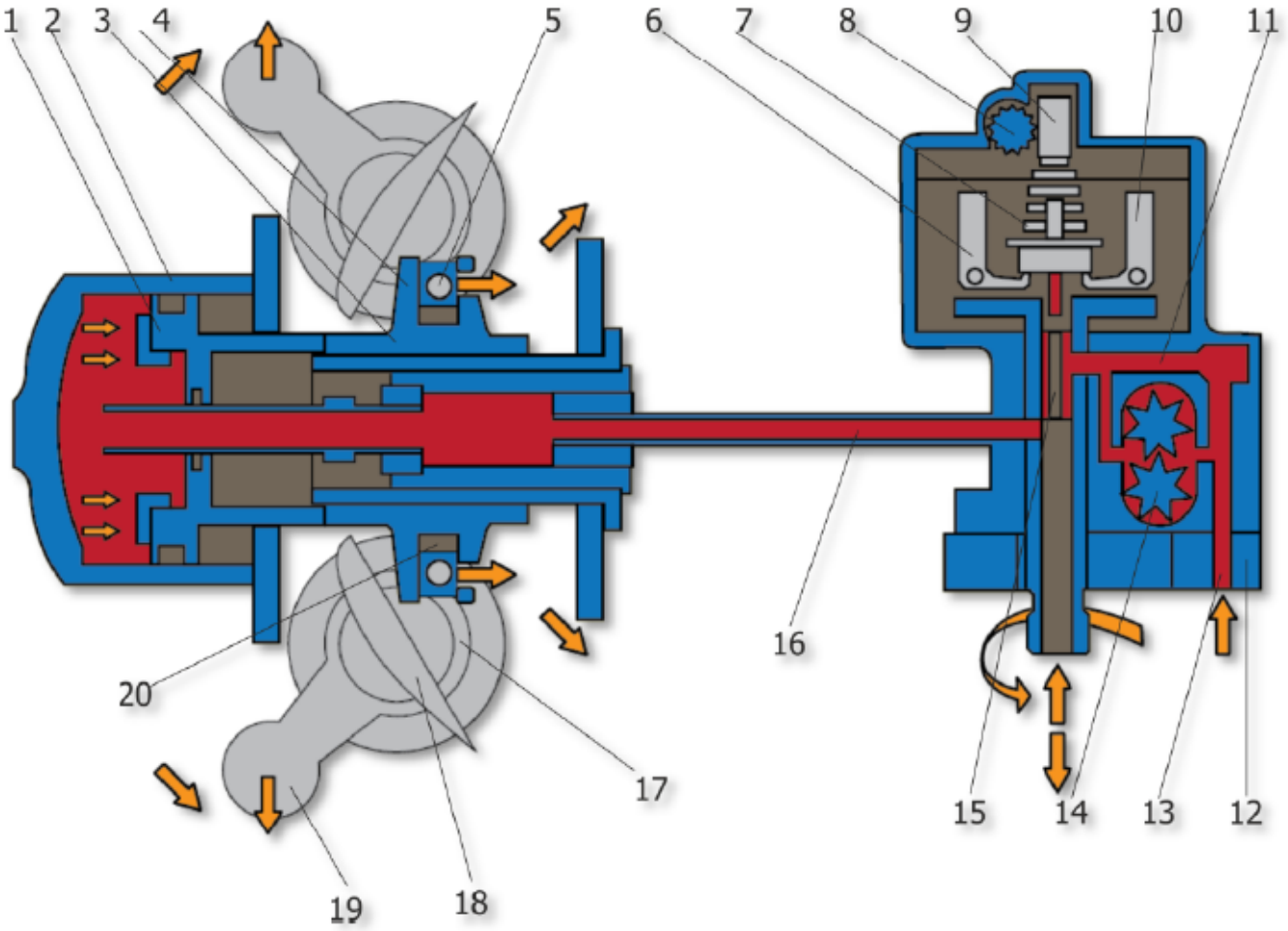


Figure 10. **Propeller action diagram (engine on-speed).**

1 - piston; 2 - cylinder; 3 - scissor; 4 - scissor eye lugs; 5 - axis pin; 6 - centrifugal weight axes; 7 - spring; 8 - cogwheel; 9 - crown; 10 - centrifugal weights; 11 - oil outlet through the pressure relief valve; 12 - regulator case; 13 - oil supply channel from the engine; 14 - regulator oil pump; 15 - slide valve; 16 - oil supply channel to the cylinder; 17 - cup; 18 - blade; 19 - counterweight; 20 - socket.

Operational Limits	
Max Allowable Speed	420 km/h
Never-Exceed Speed for flight manoeuvers	320 km/h
Never-Exceed Speed with landing gear deployed	200 km/h
Never-Exceed Speed with flaps deployed	170 km/h
Max G (Positive)	+7
Max G (Negative)	-5
Max Altitude due to lack of oxygen supply equipment	4000 m
Max Recommended/Demonstrated Headwind on Takeoff & Landing	15 m/s Approx. 30 kts
Max Recommended/Demonstrated Crosswind under 90 deg on Takeoff & Landing	6 m/s Approx. 11 kts

Stall Speeds (km/h)	
Direct Flight	110
Inverted Flight	140
With Flaps Deployed	100

Flight Mode	Indicated Air-speed, km/h	Vertical Speed, km/h	Engine Crank-shaft Speed, %	Engine Boost, mmHg
Climb	160	5	70	700
Level flight	170	0	64	500
Turns in level flight	170	0	64	600
Gliding	160	3	41	300

Mass & Alignment Data	
Aircraft empty weight	1035 kg
Max Takeoff weight	1315 kg
Max Landing weight	1315 kg
Air Crew with S-4U parachute weight	180 kg
Fuel Weight (Fully loaded)	90 kg
Oil Weight (Topped)	10 kg
Permissible centre-of-gravity range	17.5-27 % MAC (Mean Aerodynamic Chord)
Aircraft centre-of-gravity range with landing gear deployed	19.0 % MAC (Mean Aerodynamic Chord)

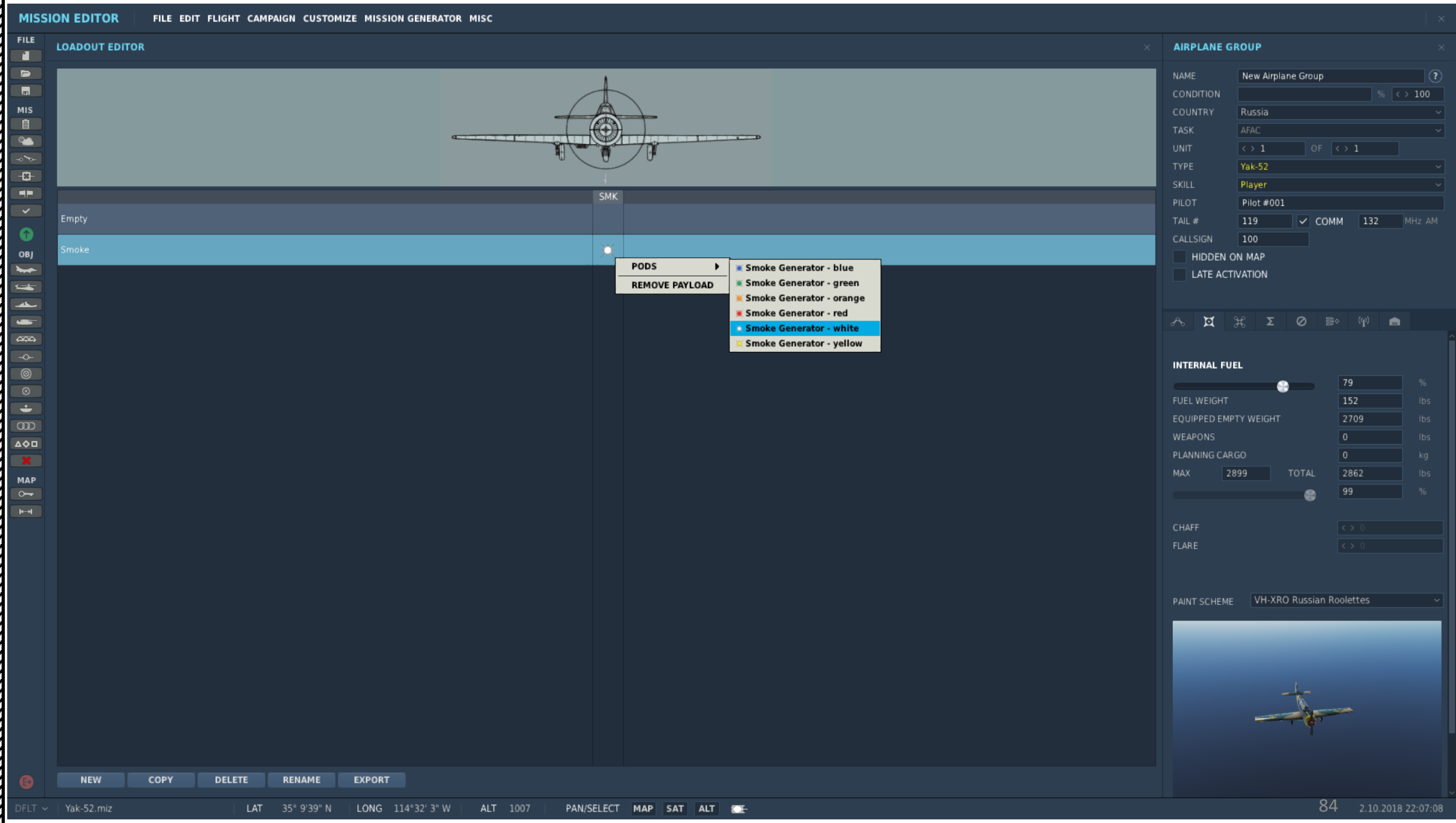
EQUIPMENT OVERVIEW

- A smoke generation system is available in the Yak. However, it must be equipped via the Mission Editor.
- To activate smoke, simply press the Smoke button on your stick.

Here is a link of how a smoke generation system is installed in the Yak
http://yakkesfoundation.blogspot.com/2008/03/fitting-smoke-system-in-yak-52.html

Reference: PlaneBoard.com (http://www.planeboard.com/yakovlev/yak-52/x6WYcLMx)

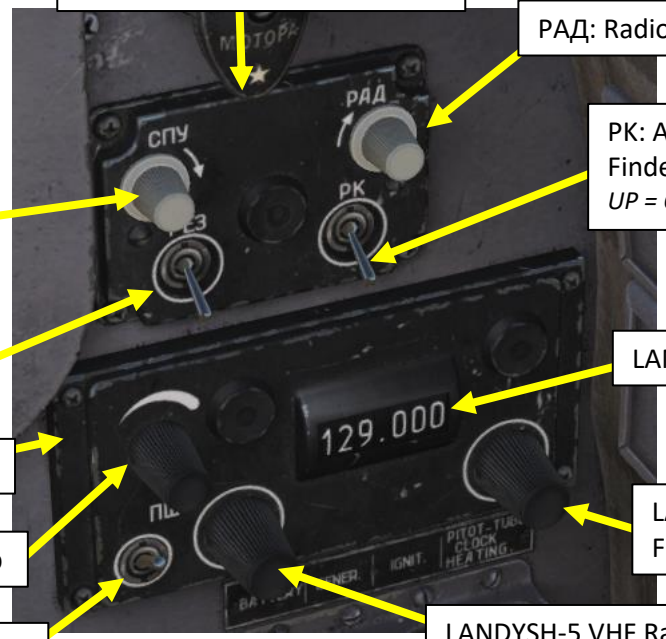
Smoke Generation System Switch
UP: OFF
DOWN: ON


MISSION EDITOR
FILE EDIT FLIGHT CAMPAIGN CUSTOMIZE MISSION GENERATOR MISC
LOADOUT EDITOR
SMK
Empty
Smoke
PODS
REMOVE PAYLOAD
Smoke Generator - blue
Smoke Generator - green
Smoke Generator - orange
Smoke Generator - red
Smoke Generator - white
Smoke Generator - yellow
NEW
COPY
DELETE
RENAME
EXPORT
AIRPLANE GROUP
NAME New Airplane Group
CONDITION 100
COUNTRY Russia
TASK AFAC
UNIT 1 OF 1
TYPE Yak-52
SKILL Player
PILOT Pilot #001
TAIL # 119
COMM 132 MHz AM
CALLSIGN 100
HIDDEN ON MAP
LATE ACTIVATION
INTERNAL FUEL
79 %
FUEL WEIGHT 152 lbs
EQUIPPED EMPTY WEIGHT 2709 lbs
WEAPONS 0 lbs
PLANNING CARGO 0 kg
MAX 2899 TOTAL 2862 lbs
99 %
CHAFF 0
FLARE 0
PAINT SCHEME VH-XRO Russian Roolettes
DFLT Yak-52.miz
LAT 35° 9'39" N
LONG 114°32' 3" W
ALT 1007
PAN/SELECT MAP SAT ALT
2.10.2018 22:07:08

The Yak-52 is equipped with a **Landysh-5 VHF radio** and a **SPU-9 Intercom**. The intercom is not simulated yet, but in real life it is used to communicate between the front and rear seat. In real life, VHF radio communication is stable only within line of sight. The simulator also has built-in algorithms for calculating distance and the radio shadowing caused by the terrain horizon. A necessary condition for the transmission of messages or commands is line of sight to the recipient as well as a distance of not more than 100 - 150 km. In such cases where the recipient is located beyond this distance, or line of sight is obscured by terrain, the message will not be received.

<u>To transmit on the VHF radio:</u>

a) Set the Radio Power and SPU-9 Intercom circuit breakers – ON
b) Set VHF Radio Squelch Switch – DOWN (OFF)
c) Set desired VHF frequency
d) Adjust VHF volume knob
e) Press the "COMM – Push to Talk" key "RALT+ /" to transmit.



SPU-9 Intercom Control Panel

РАД: Radio Volume Knob

РК: ADF (Automatic Direction Finder) Switch
UP = ON / DOWN = OFF

СПУ : SPU-9 Intercom Volume

SPU-9 Intercom Mode
Stand-by (UP) / MAIN (DOWN)

LANDYSH-5 VHF Radio Frequency

LANDYSH-5 VHF Radio Control Panel

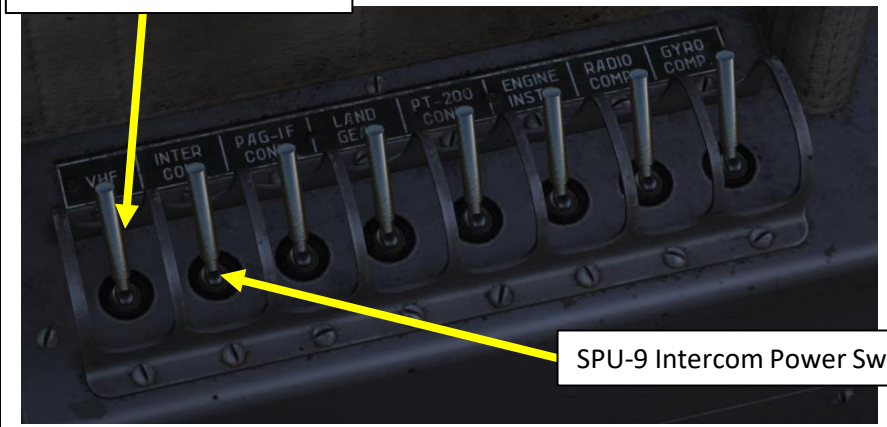
LANDYSH-5 VHF Radio 25 KHz Frequency Selector Dial

LANDYSH-5 VHF Radio Volume Control Knob

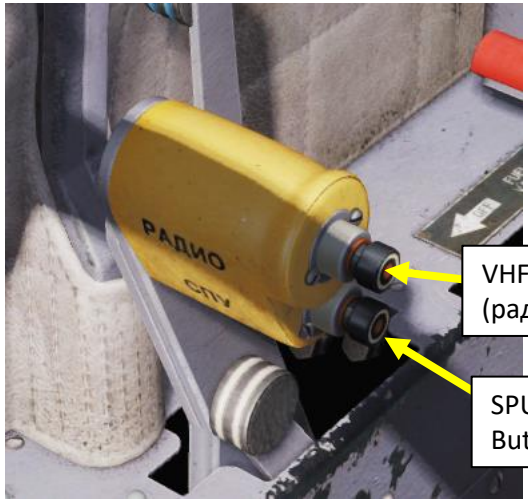
LANDYSH-5 VHF Radio 1 MHz Frequency Selector Dial

LANDYSH-5 VHF Radio Squelch (Noise Suppression) Switch
UP: ON (Squelch)
DOWN: OFF

VHF Radio Power Switch

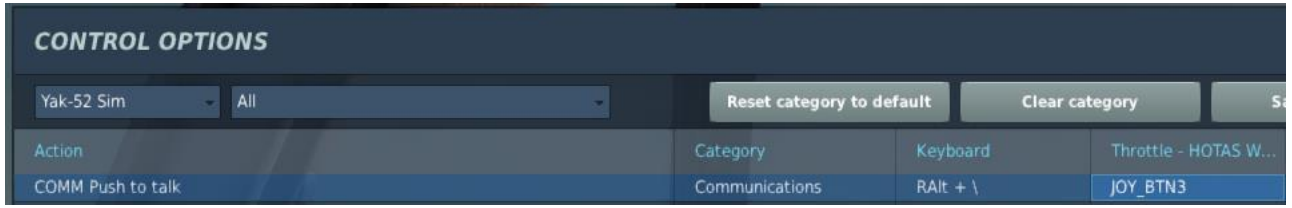


SPU-9 Intercom Power Switch



VHF Radio Push-to-Talk Button (радио)

SPU-9 Intercom Push-to-Talk Button (СПУ)



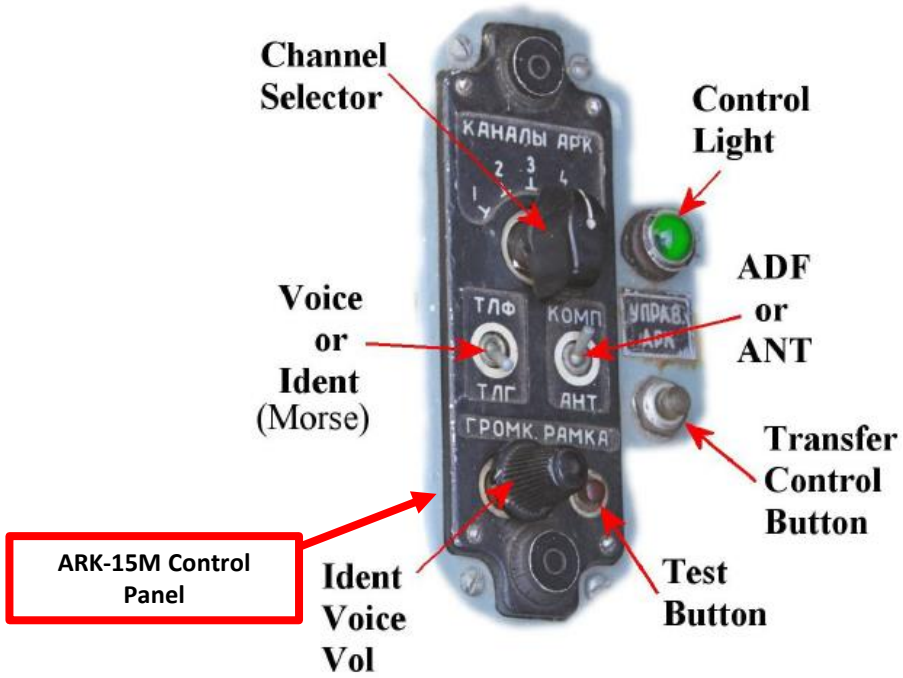
RADIO FREQUENCIES – AIRFIELDS

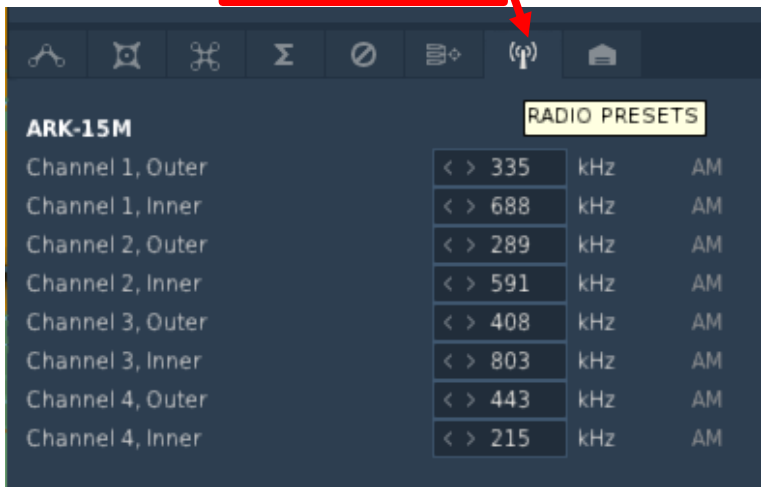
LOCATION	FREQUENCY (MHz)
Anapa	121.0
Batumi	131.0
Beslan	141.0
Gelendzhik	126.0
Gudauta	130.0
Kobuleti	133.0
Kutaisi	134.0
Krasnodar Center	122.0
Krasnodar Pashkovsky	128.0
Krymsk	124.0
Maykop	125.0
Mineral'nye Vody	135.0
Mozdok	137.0
Nalchik	136.0
Novorossiysk	123.0
Senaki	132.0
Sochi	127.0
Soganlug	139.0
Sukhumi	129.0
Tblisi	138.0
Vaziani	140.0

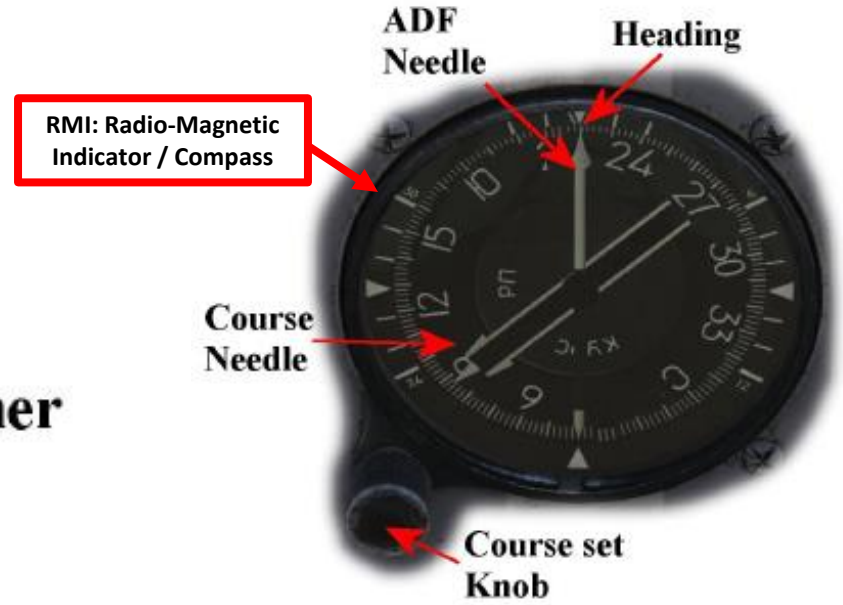
The **ARK-15M ADF** (Automatic Direction Finder) system in the Yak-52 is a little awkward to get your head around at first. You need to first understand the philosophy. The Yak-52 is a short ranged aircraft (180nm max). It was designed to fly in a limited area of operation. Russian practice is to place to NDB/Markers (Non-Directional Beacons) along the approach path of the main runway. The furthest one out being the "Outer marker" and the closest in being the "Inner marker". These typically support an ILS (Instrument Landing System) as well to provide a distance reference to those on the ILS. (Reference: IvanK)

It was also Russian practice that both runways directions each had a set of markers and were on the same frequency, although only one runway direction in use at a time. Understanding this adds some sense to the Yak ADF setup.

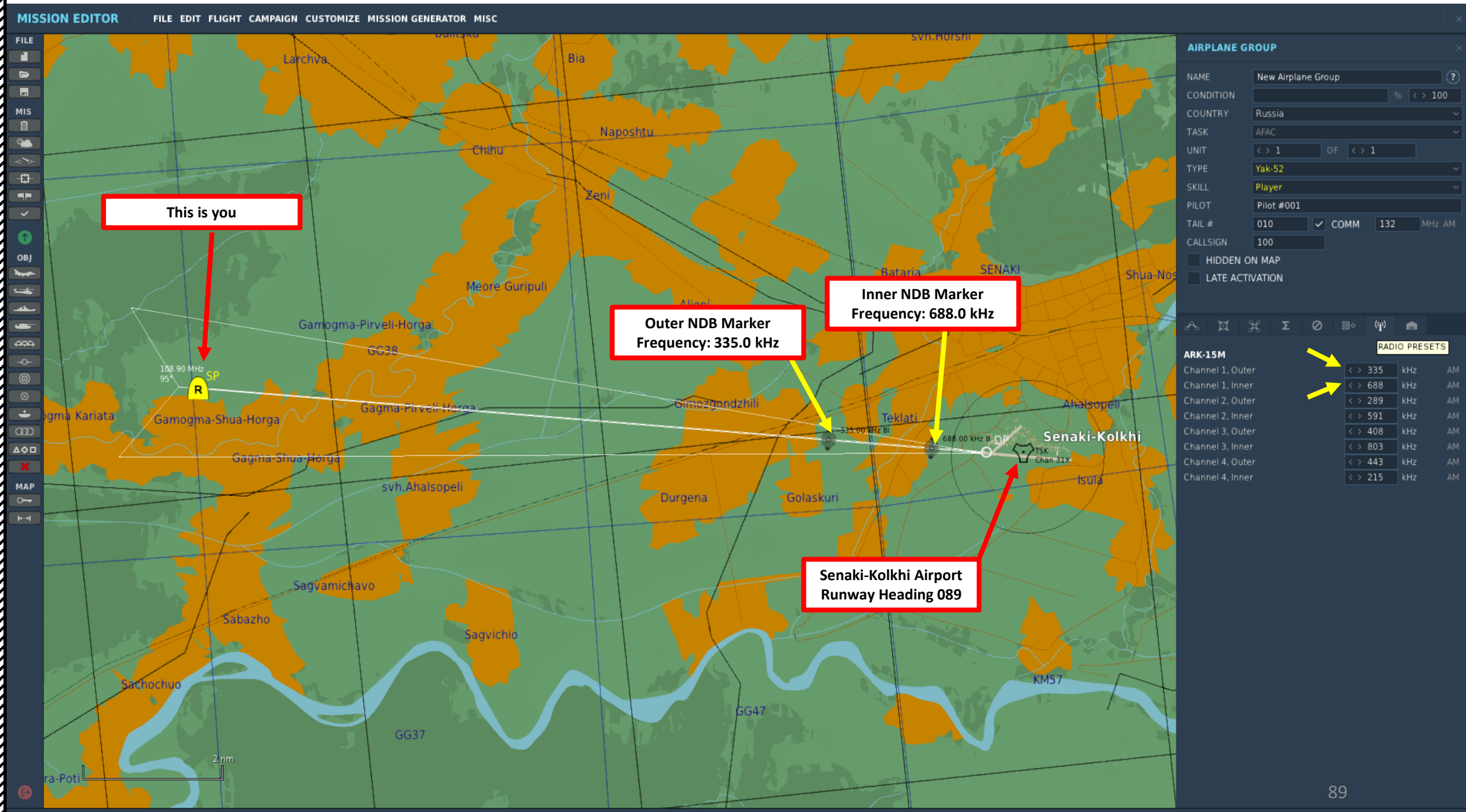
A total of 8 NDB's can be selected in the Yak-52. The tuning of the desired frequency is a maintenance task (done via the Mission Editor) and is done before flight on a control unit located in the fuselage behind the rear seat. Once configured, these 8 preset channel frequencies are all the pilot can tune. The pilot basically sets the Channel Selector with 4 positions, then chooses whether to select the Outer or Inner marker preset channels.





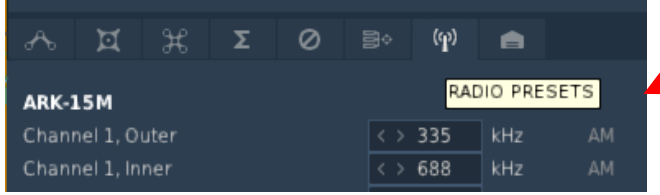


MISSION EDITOR – PRESET ARK-15 RADIO FREQUENCIES

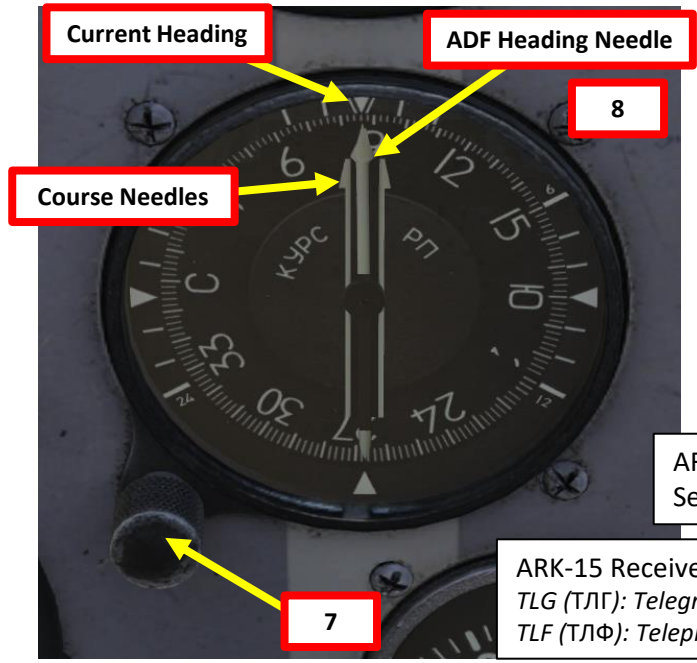


ARK-15M Procedure

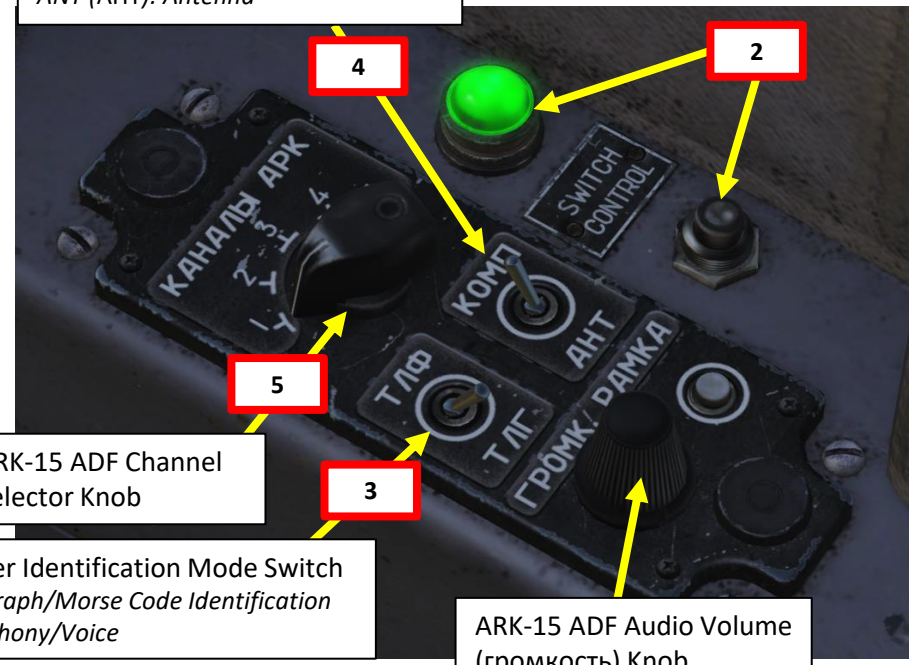
1. Verify that Radio Compass and Gyro Compass Power switches are ON
2. Press “Switch Control” button to transfer ADF control to the front seat and ensure green light is illuminated
3. Select IDENT (TLG) mode to hear Morse Identification code of selected NDB station
4. Select COMP (Radio-Compass) mode to display ADF heading on RMI (Radio-Magnetic Compass)
5. Select ADF Channel with the selector Knob
6. Select Outer or Inner Marker based on what NDB beacon you are tracking (see preset table in mission editor)
7. Set RMI course to 089 (Heading of the Senaki runway 09)
8. Steer the aircraft so that your current heading is lined up with the ADF heading needle and the ADF heading needle is lined up between the Course needles.



ARK-15M Preset Frequencies



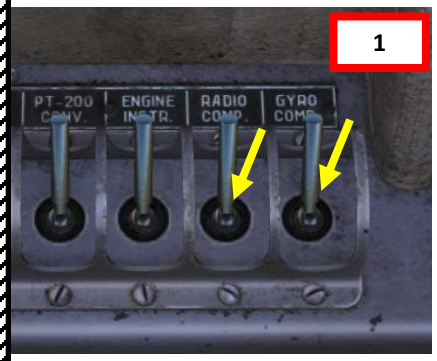
ARK-15 ADF Mode Switch
COMP (КОМП): Radio-compass
ANT (АНТ): Antenna

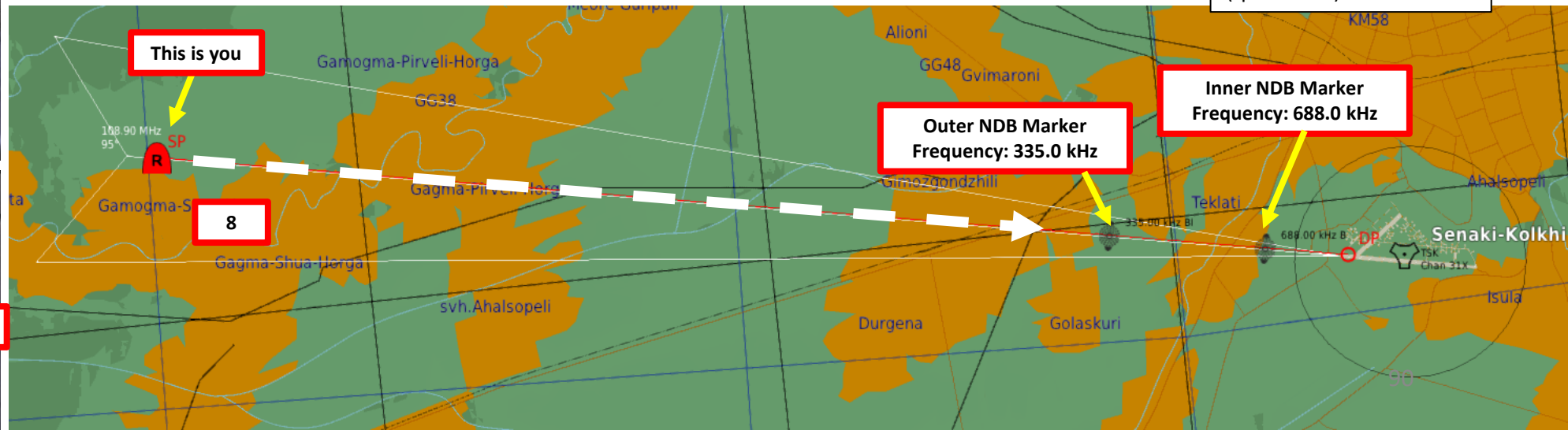


ARK-15 ADF Channel Selector Knob

ARK-15 Receiver Identification Mode Switch
TLG (ТЛГ): Telegraph/Morse Code Identification
TLF (ТЛФ): Telephony/Voice

ARK-15 ADF Audio Volume (громкость) Knob





Caucasus Airfield Data, With SHORAN

Airfields	Artificial Airfield Location	SHORAN channels		ATC Frequency MHz	Outer NDB Frequency KHz	Inner NDB Frequency KHz
		Н	П			
URKI Krasnodar Tsentralniy «Volokno» (Russia)	09-27° Runway=2500x40 m	40	38 (09°)	251.0/122.0/ 38.60/3.80	625	303
URKH Maykop «Khanskaya » (Russia)	04-22° Runway=3200x40 m	34	36 (04°)	254.0/125.0/ 39.20/3.95	288	591
URKW Krymsk «Taymyr» (Russia)	04-22° Runway=2600x40 m	28	26	253.0/124.0/ 39.0/3.90	408	803
XRMF Mozdok «Raspiska» (Russia)	08-27° Runway=3100x80m	20	22	266.0/137.0/ 41.60/4.55	525	1065

Nevada Airfield Data

Airfields	Artificial Airfield Location	TACAN Channel	ILS Frequency	ATC Frequency MHz
KXTA Groom Lake AFB (USA)	14L-32R 3500 m	18X (GRL)	32 ILS - 109.30 (GLRI)	252.0/123.0/38.8
KINS Creech AFB (USA)	13-31 1500 m, 08-27 2700 m	87X (INS)	13 ILS - 108.5 (ICRS)	251.0/122.0/38.6
KLSV Nellis AFB (USA)	03L-21R 3000 m, 03R-21L 3000 m	12X (LSV)		254.0/125.0/39.2
KLAS Mc Carran International (USA)	07К-25Д 3100 m 07Д-25К 3300 m 01К-19Д 2500 m 01Д-19К 2500 m	116X (LAS)	25 ILS – 111.75 (IRLE)	253.0/124.0/39.0

Caucasus Airfield Data

Airfields	Artificial Airfield Location	ATC Frequency MHz	Outer NDB Frequency KHz	Inner NDB Frequency KHz
UG23 Gudauta – Bambora (Abkhazia)	15-33° Runway=2500x40 m	209.00/130.0 40.20/4.20	---	395 (33°)
UG24 Tbilisi – Soganlug (Georgia)	14-32° Runway=2400x40 m	218.0/139.0 42.0/4.65	---	---
UG27 Vaziani (Georgia)	14-32° Runway=2500x40 m	219.0/140.0 42.20/4.70	---	---
UG5X Kobuleti (Georgia)	07-25° Runway=2400x40 m	212.0/133.0 40.80/4.35	870	490
UGKO Kutaisi - Kopitnari (Georgia)	08-26° Runway=2500x40 m	213.0/134.0 41.0/4.40	---	477 (08°)
UGKS Senaki - Kolkhi (Georgia)	09-27° Runway=2400x40 m	211.0/132.0 40.60/4.30	335	688
UGSB Batumi (Georgia)	13-31° Runway=2400x40 m	210.0/131.0 40.40/4.25	---	430 (31°)
UGSS Sukhumi - Babushara (Abkhazia)	12-30° Runway=2500x40 m	208.0/129.0 40.0/4.15	489	995
UGTB Tbilisi - Lochini (Georgia)	13-31° Runway=3000x40 m	217.0/138.0 41.80/4.60	342 (13°) 211 (31°)	923 (13°) 435 (31°)
URKA Anapa - Vityazevo (Russia)	04-22° Runway=2900x40 m	200.0/121.0 38.40/3.75	443	215
URKG Gelenzhik (Russia)	04-22° Runway=1800x40 m	205.0/126.0 39.40/4.00	---	1000
URKK Krasnodar - Pashkovskiy (Russia)	05-23° Runway=3100x40 m	207.0/128.0 39.80/4.10	493	240
URKN Novorossiysk (Russia)	04-22° Runway=1780x40 m	202.0/123.0 38.80/3.85	---	---
URMM Mineralnye Vody (Russia)	12-30° Runway=3900x40 m	214.0/135.0 41.20/4.45	583	283
URMN Nalchik (Russia)	06-24° Runway=2300x40 m	215.0/136.0 41.40/4.50	718 (24°)	350 (24°)
URMO Beslan (Russia)	10-28° Runway=3000x40 m	220.0/141.0 42.40/4.75	1050(10°)	250 (10°)
URSS Sochi - Adler (Russia)	06-24° Runway=3100x40 m	206.0/127.0 39.60/4.05	---	761 (06°)

THE IMPORTANCE OF INSTRUMENTS

- **Pressure sensors** reading the air pressure outside your aircraft are what allow you to know at what **airspeed** you are flying, at what **altitude** you are and your **vertical velocity**. These indications are given on the airspeed indicator, altimeter and variometer.
- A Pitot-Static system consists of a **Pitot Tube** (reads total pressure) and a **Static Port** (reads static pressure).
- If you have a static port or a pitot tube malfunction, your total pressure and static pressure sensor readings will be affected.
- A wrong total pressure or static pressure reading will result in your gauges displaying wrong airspeed, altimeter and vertical velocity indications.
- There is a **relationship between airspeed, altimeter, the vertical velocity and a pitot-static system.**
- The ALTIMETER needs a static pressure sensor (static port)
- The VARIOMETER needs a static pressure sensor (static port)
- The AIRSPEED indicator needs a dynamic pressure reading (pitot tube + static port)

1. Airspeed can be found with air pressure sensors placed on the aircraft.
2. There are 2 types of pressure: static and dynamic.
3. Static pressure is the ambient air pressure
4. Dynamic pressure is based on the pressure differential between you and a moving fluid (like wind!)
5. Total pressure = dynamic pressure + static pressure
6. Dynamic pressure = total pressure - static pressure
7. Dynamic pressure is a function of air density (which varies with altitude) and airspeed.
8. $\text{Dynamic Pressure} = \frac{1}{2} * (Air\ Density) * (Airspeed)^2$
9. From that equation, we know that airspeed is found from dynamic pressure.
10. Therefore, if we have sensors for the total pressure (obtained from pitot tube, which is like a dog with its head out of a car) and a static pressure (obtained from a static port, more on that next slide), we can find easily your airspeed!
11. $Airspeed = \sqrt{\frac{Dynamic\ Pressure}{0.5 * (Air\ Density)}} = \sqrt{\frac{(Total\ Pressure) - (Static\ Pressure)}{0.5 * (Air\ Density)}}$

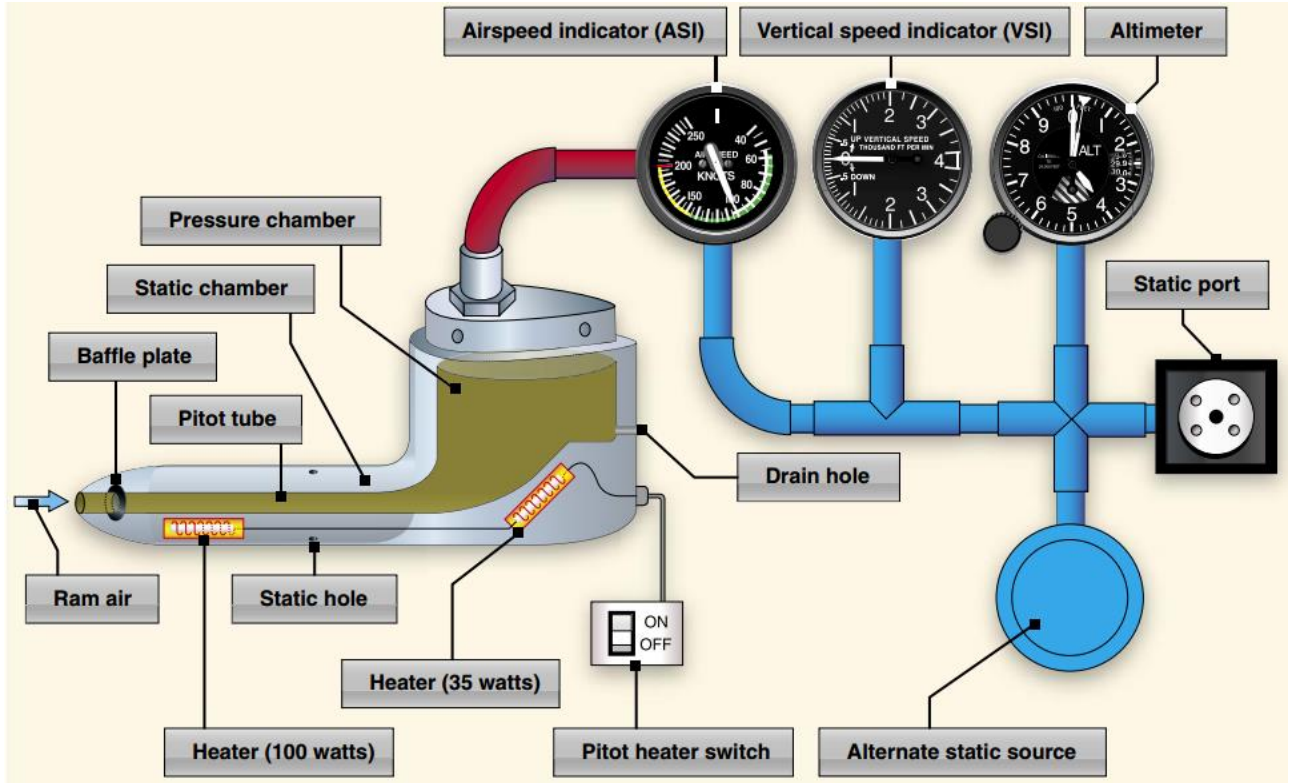
TOTAL PRESSURE (DOG FEELS THE WIND SPEED + AMBIENT PRESSURE)

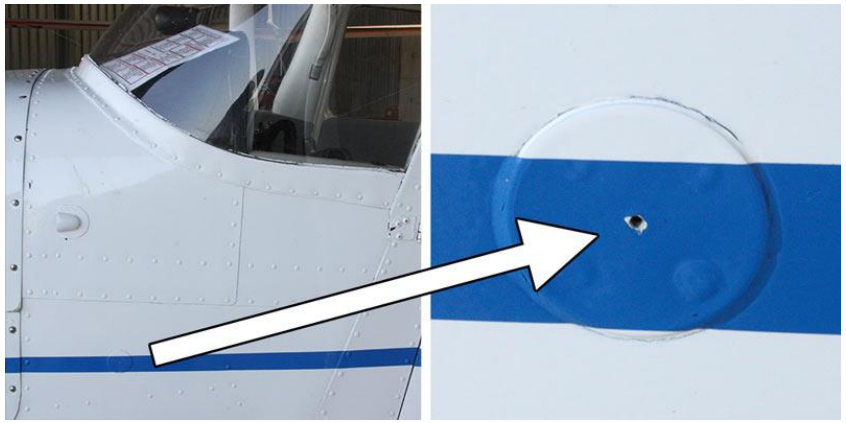
STATIC PRESSURE (DOG FEELS AMBIENT PRESSURE ONLY)

THE IMPORTANCE OF INSTRUMENTS

- A pitot tube is usually fit on the wings, which is where there is the most airflow to get the most accurate measurement of total pressure possible (since you need to be aligned with the moving fluid).
- A static port is a pressure sensor that needs to be placed in a particular place in order to measure a proper "static pressure" (which means in an area undisturbed by wind, undisturbed by dynamic effects). This means that the static port must be placed in a way that the sensor is perpendicular to the wind (and will not feel its pressure effect).

INSTRUMENT	NEEDS STATIC PRESSURE (STATIC PORT)	NEEDS TOTAL PRESSURE (PITOT TUBE)
Airspeed	X	X
Altimeter	X	
Variometer	X	





The static port pressure sensor will feel the pressure of the air laterally (or from the side of the aircraft), but will not feel the dynamic pressure created by the motion of the aircraft. See the "dog in car" analogy from previous page.

THE IMPORTANCE OF INSTRUMENTS

- Static and Total Pressure failures can be simulated in the instructor's rear cockpit (Instruments Failure Simulation Panel).
- A student pilot can recognize a **static pressure failure** if his **altimeter** and **variometer** readings are all "frozen". The airspeed indicator will still function, but will use a "frozen" static pressure reference value, which will give you an **incorrect airspeed reading as you change altitude**.
- A student pilot can recognize a **total pressure failure** if his **airspeed** reading is "frozen".
- **Corrective action includes:**
  - **Ensure Pitot Heat is ON (sensor could be blocked by ice)**

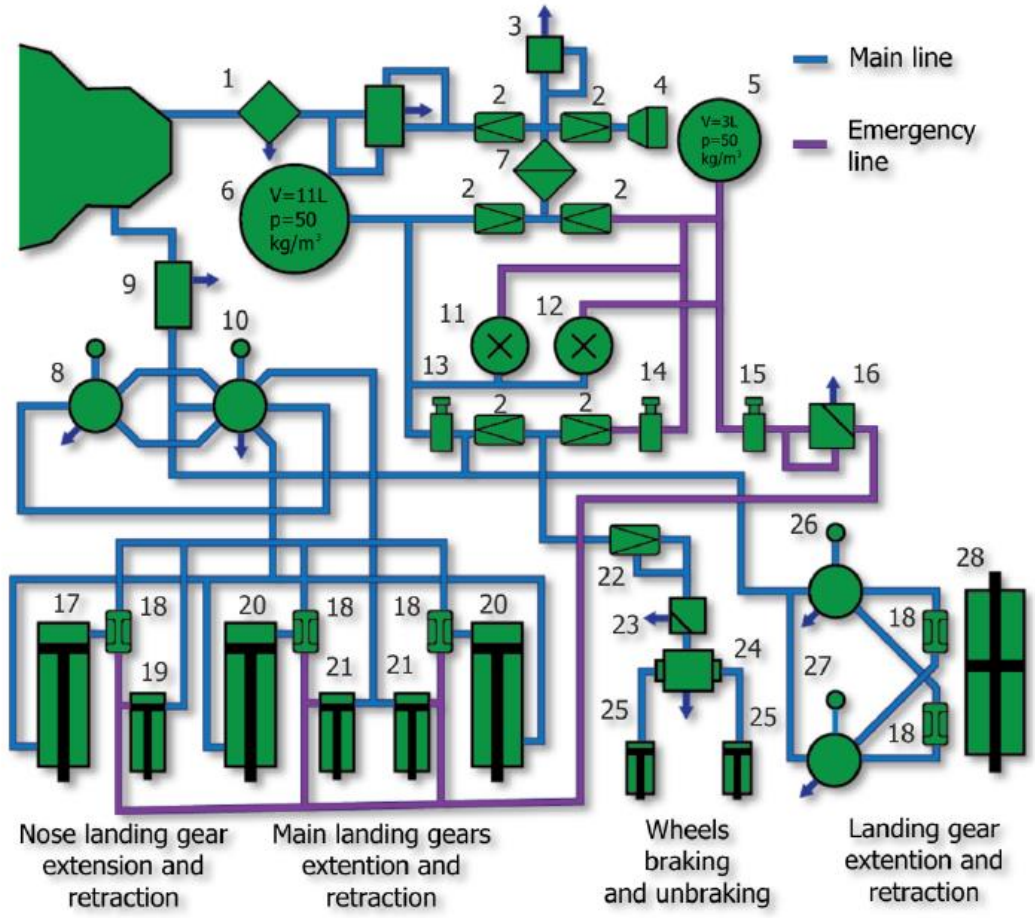
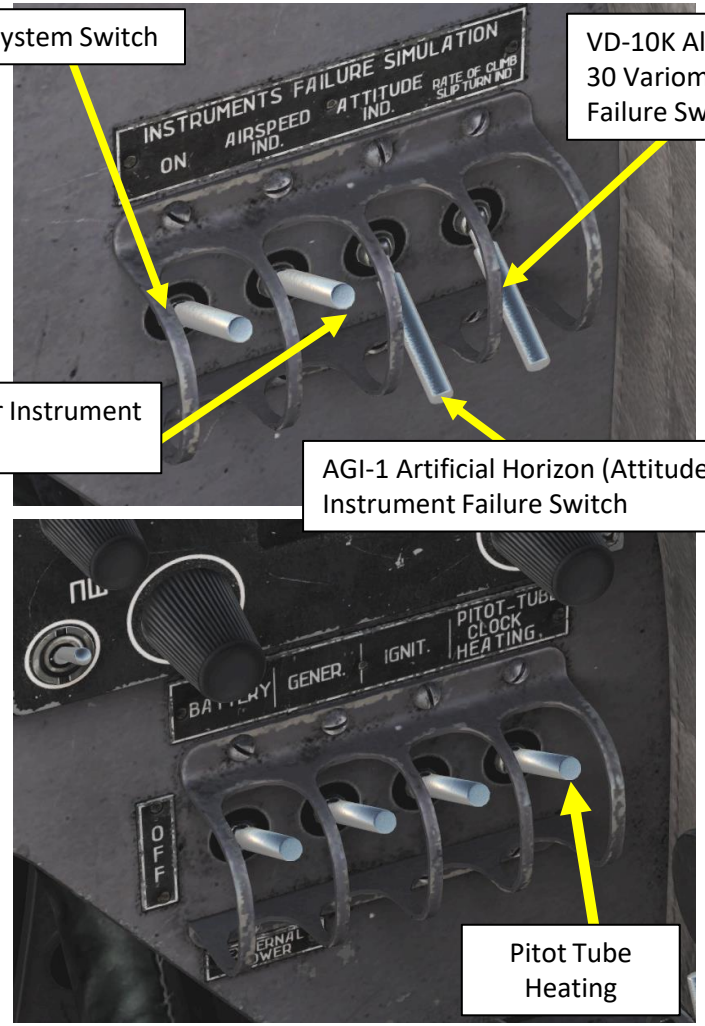


Figure 6. Schematic diagram of the air system.



1 - FT decanter; 2 - non-return valves; 3 - pressure reducing valve; 4 - filler valve; 5 - emergency system tank; 6 - main system tank; 7 - 31VF3A filter; 8 - 625300M three-way valve; 9 - EK-48 electro-pneumatic valve; 10 - undercarriage command crane; 11, 12 - 2M-80 manometers; 13 - 992AT valve (network charging); 14, 15 - 992AT-3 emergency undercarriage deployment valves; 16 - 562300 bleed valve; 17 - lift; 18 - emergency valves; 19 - undercarriage front strut lock release cylinder; 20 - undercarriage main strut lift; 21 - lock release cylinders; 22 - PU-7 (U139) pressure reducer valve; 23 - UP53 / 1M valve ; 24 - PU-8 (V135) differential; 25 - brake wheels of the undercarriage main struts; 26, 27 - 625300M three-way valves; 28 - landing flap release/retract cylinder.

FLYING THE YAK

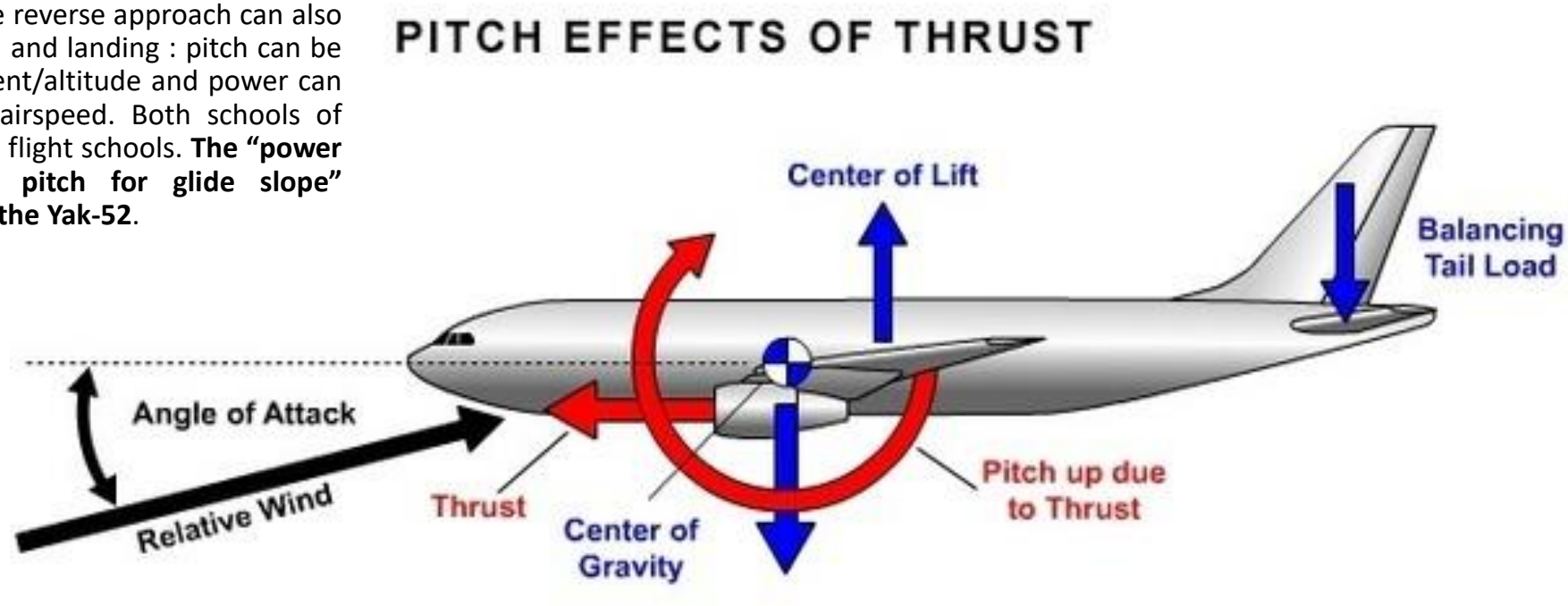
Learning to fly in real life is often quite different from learning to fly in a simulator. One of the key concepts in flying an aircraft well is being able to control your altitude and airspeed and stick to required parameters. For instance, most circuits above airports are done at specific heights (typically 1000 ft over airport elevation) and respecting these altitude restrictions is quite important for safety reasons. Maintaining airspeed during certain manoeuvers is also essential if you don't want to fall out of the sky or bounce during landing.

Cessna 152 pilots are generally taught that in non-automated aircraft, you should change aircraft pitch to control your airspeed, and adjust engine power to control your glide slope / altitude. This concept is known as « **Pitch for speed, Power for Altitude** ». This is especially useful during final approach, where precision will help you perform a smooth landing. This assumes that the aircraft is trimmed properly (i.e. the elavator trim wheel is set so that the aircraft will keep your desired attitude and the stick will not react to any aerodynamic force applied on the control surfaces).

Another way of explaining this is using the concept of Kinetic and Potential energy. *Kinetic Energy* is a fancy way ot referring to *airspeed*, while *Potential Energy* refers to *altitude*. Kinetic energy can be traded for potential energy [aircraft goes up, but slows down], and vice-versa [aircraft goes down, but accelerates].

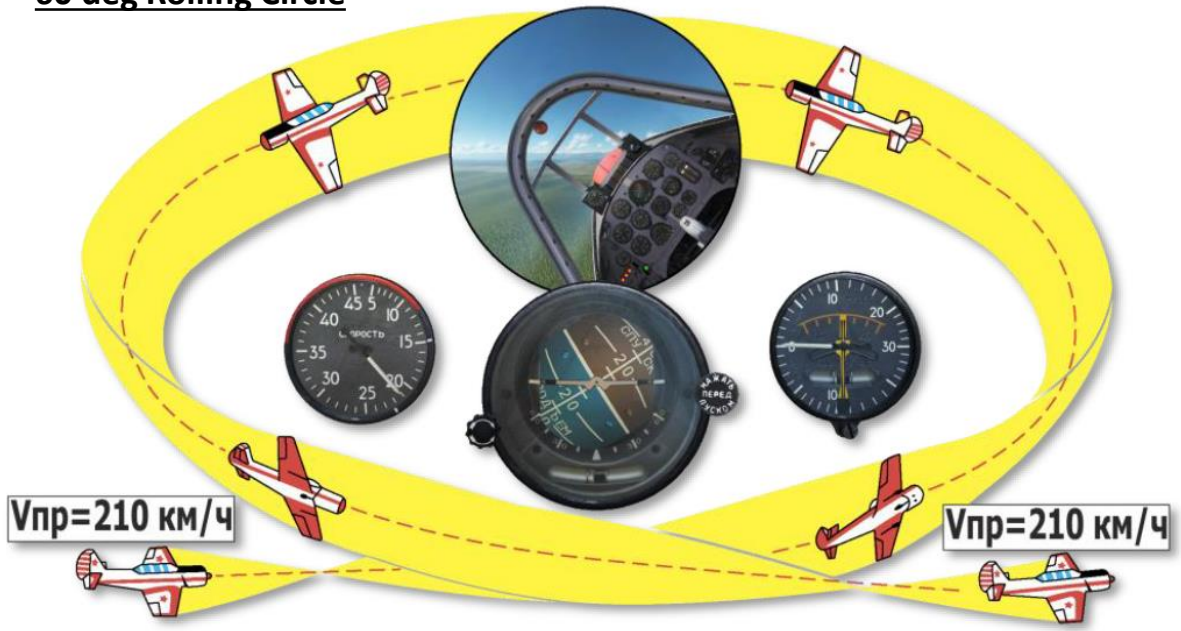
Keeping that in mind, **Power** has an effect on **Total Energy**, while **Pitch divides Total Energy** between Kinetic and Potential energy. In other words, Power up to add energy, set pitch to decide what to do with it.

Keep in mind that the reverse approach can also be used for approach and landing : pitch can be used to control descent/altitude and power can be used to control airspeed. Both schools of thought are taught in flight schools. **The "power to regulate speed, pitch for glide slope" approach is used for the Yak-52**.

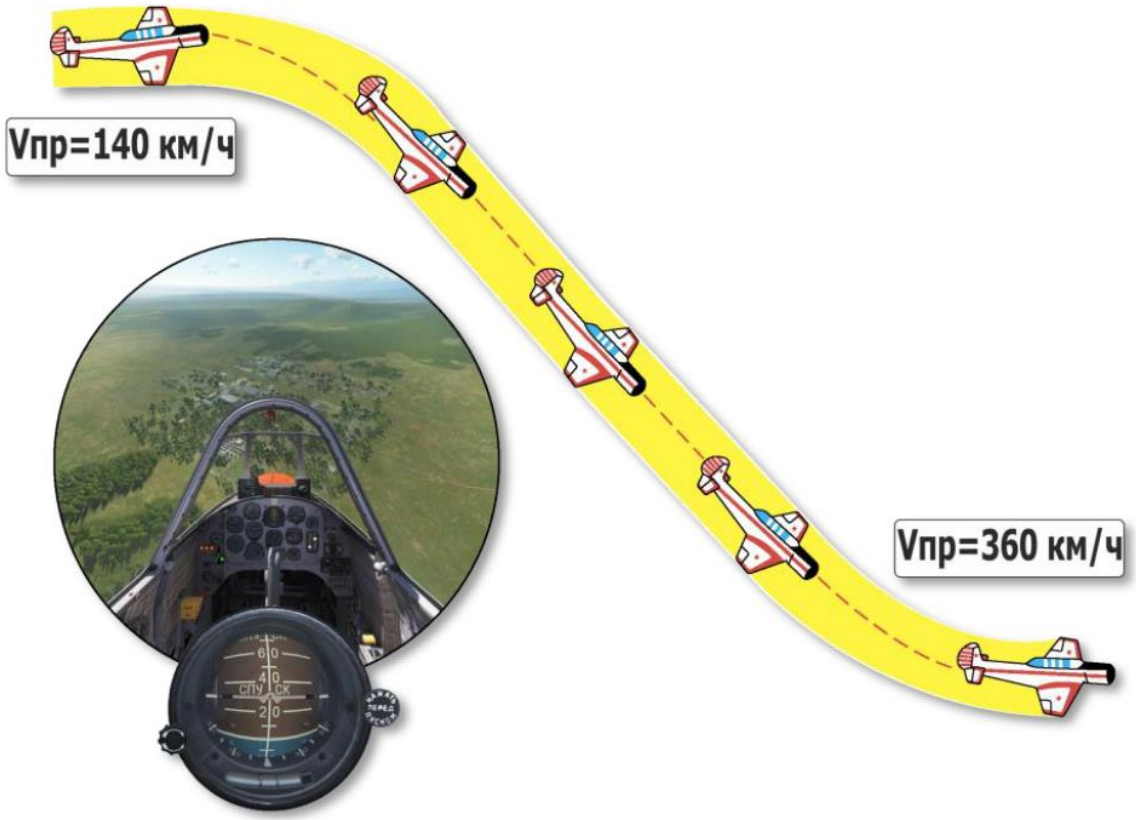


30-45 deg Rolling Circle

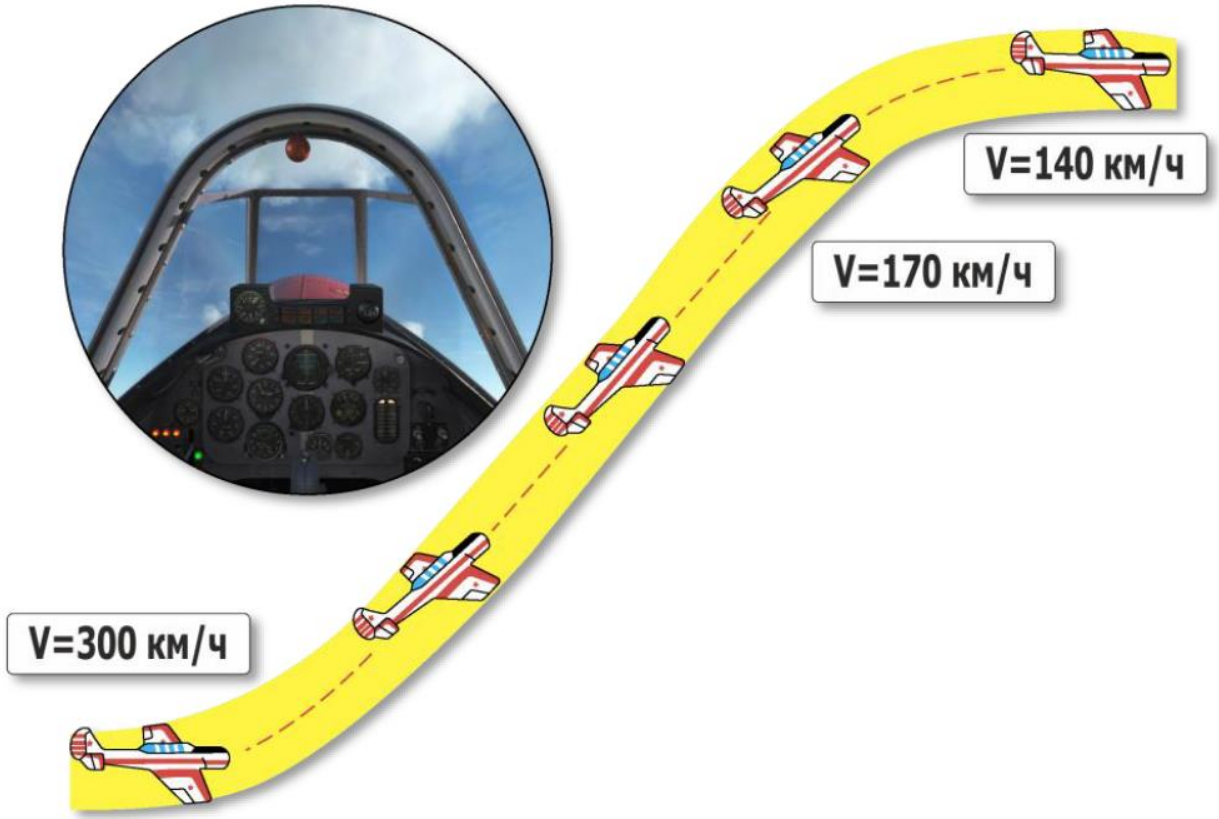
60 deg Rolling Circle



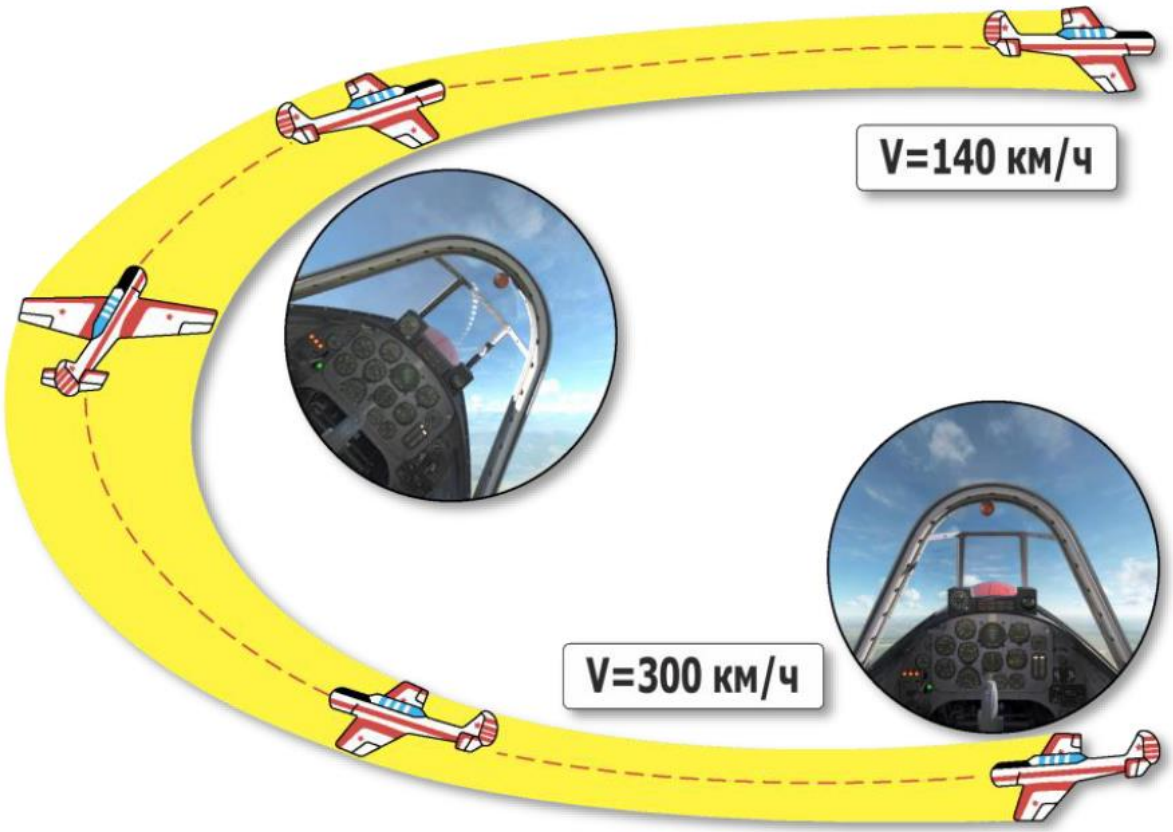
Dive Manoeuver



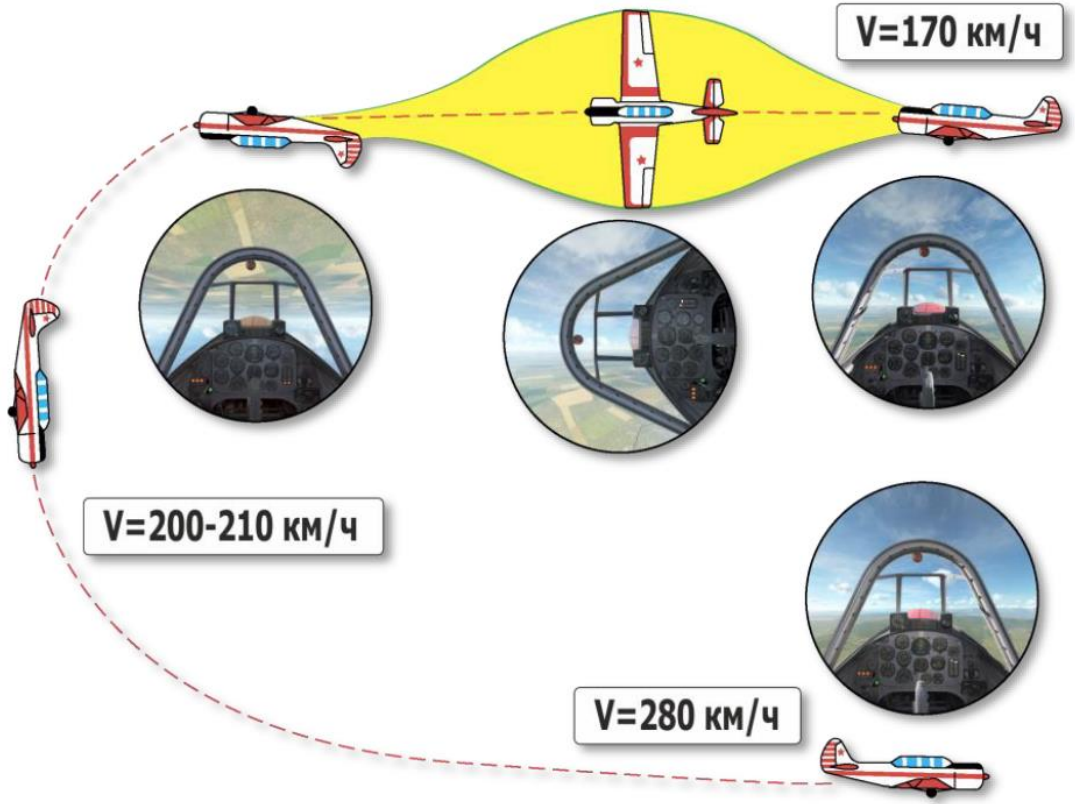
Zoom Manoeuver



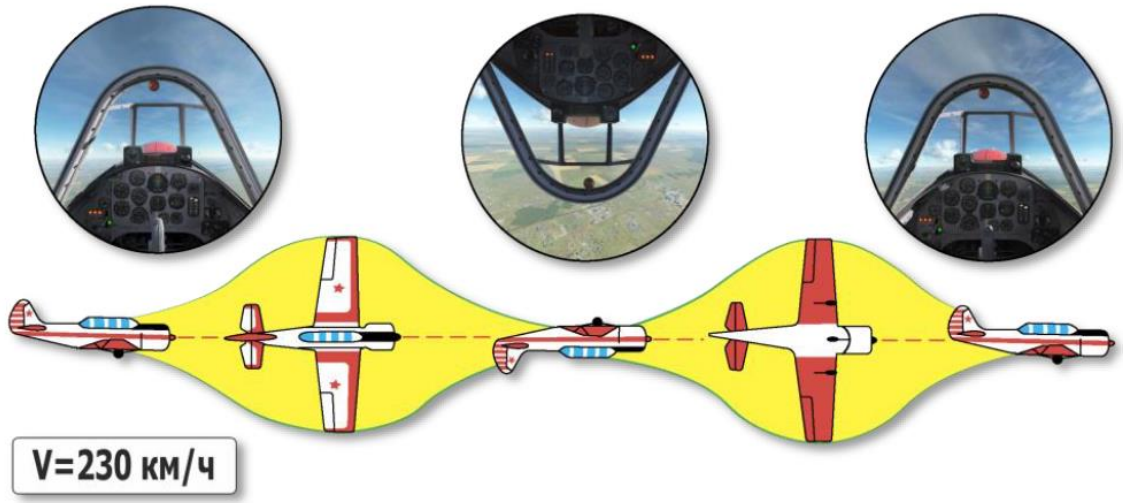
Hook Turn



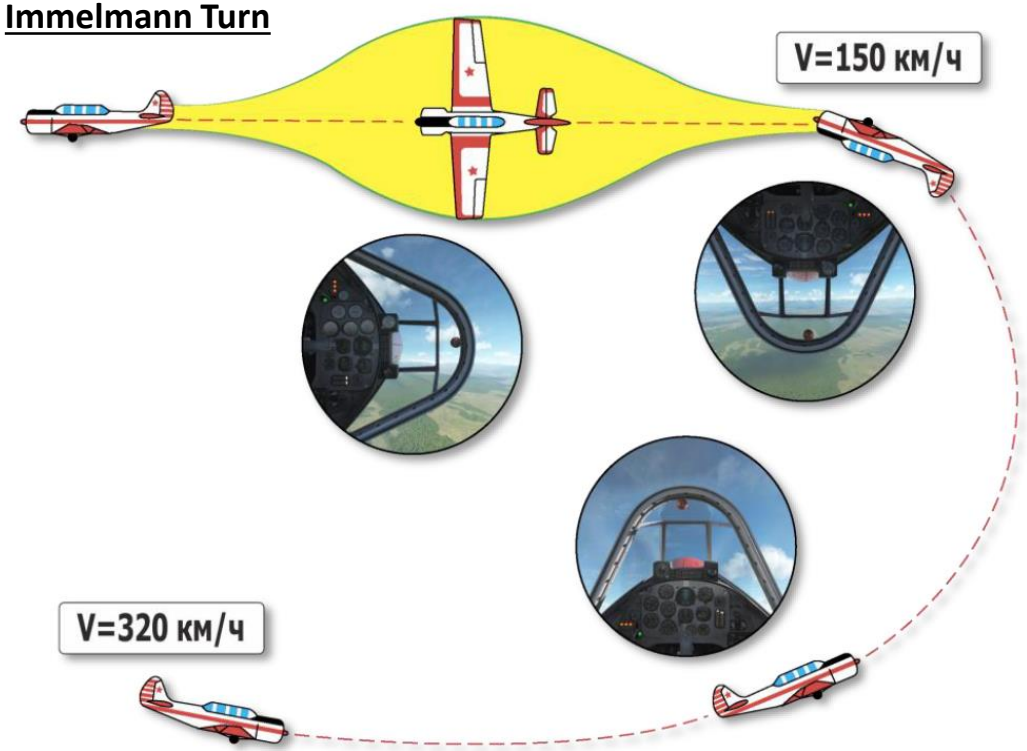
Split S



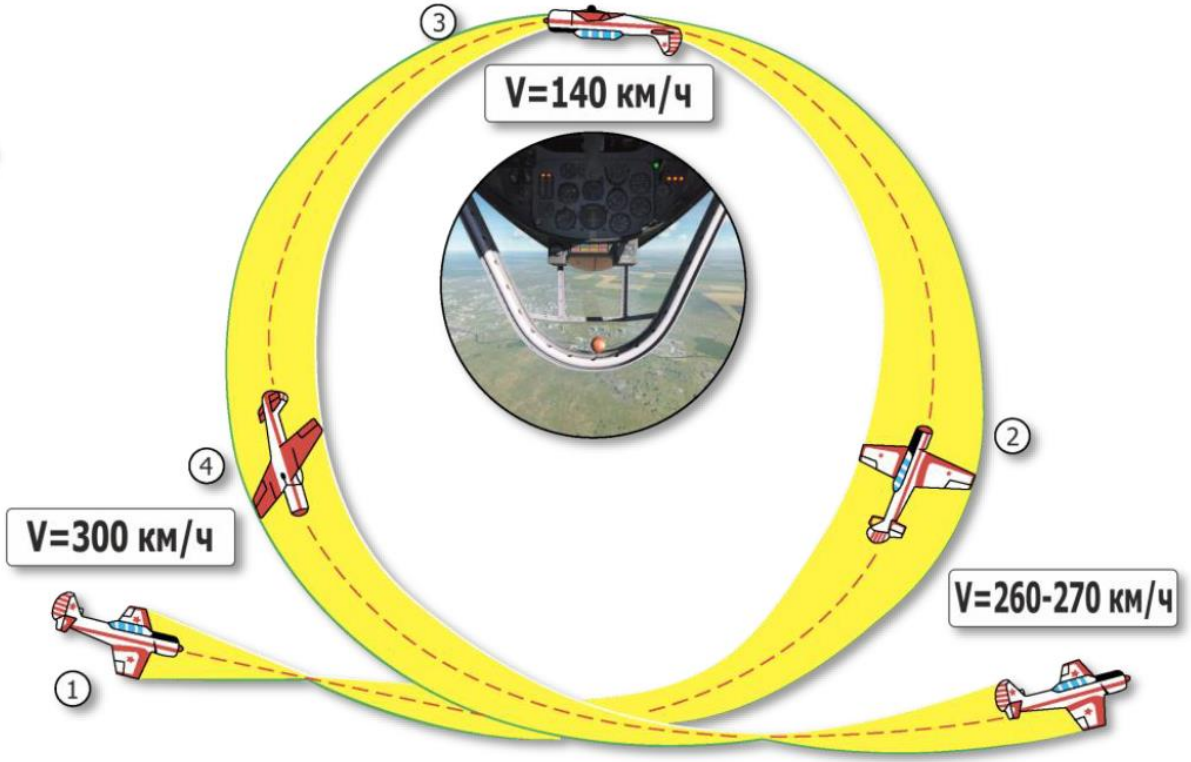
Aileron Roll



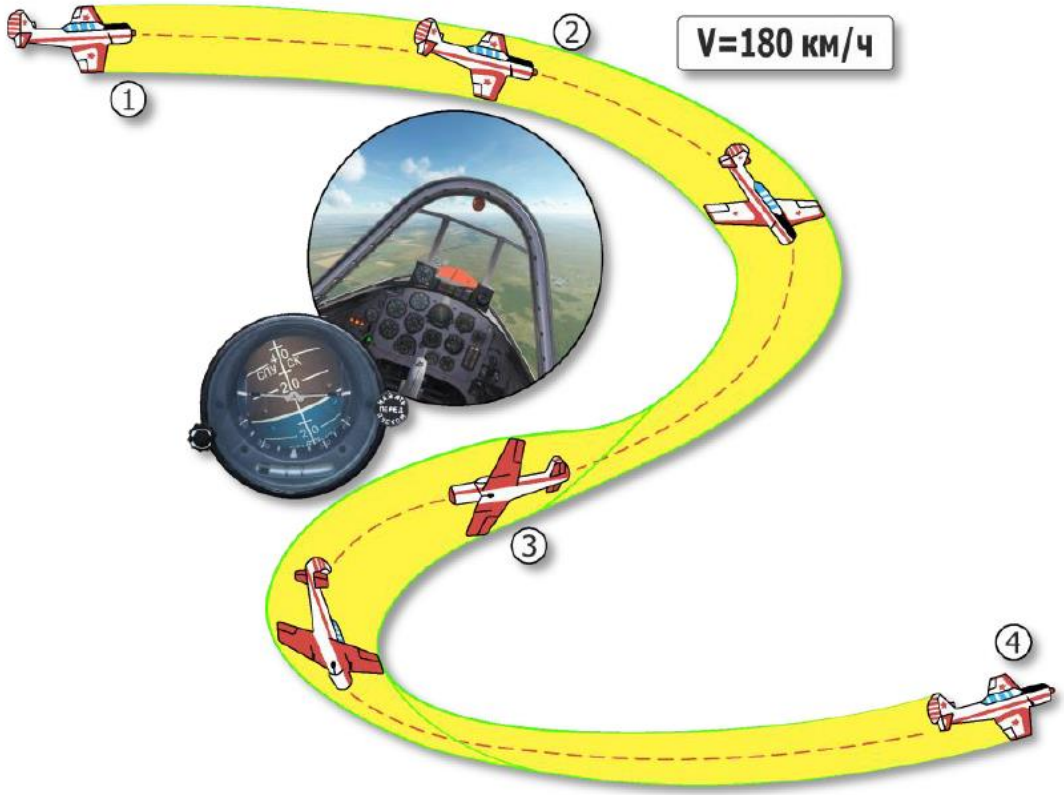
Immelmann Turn



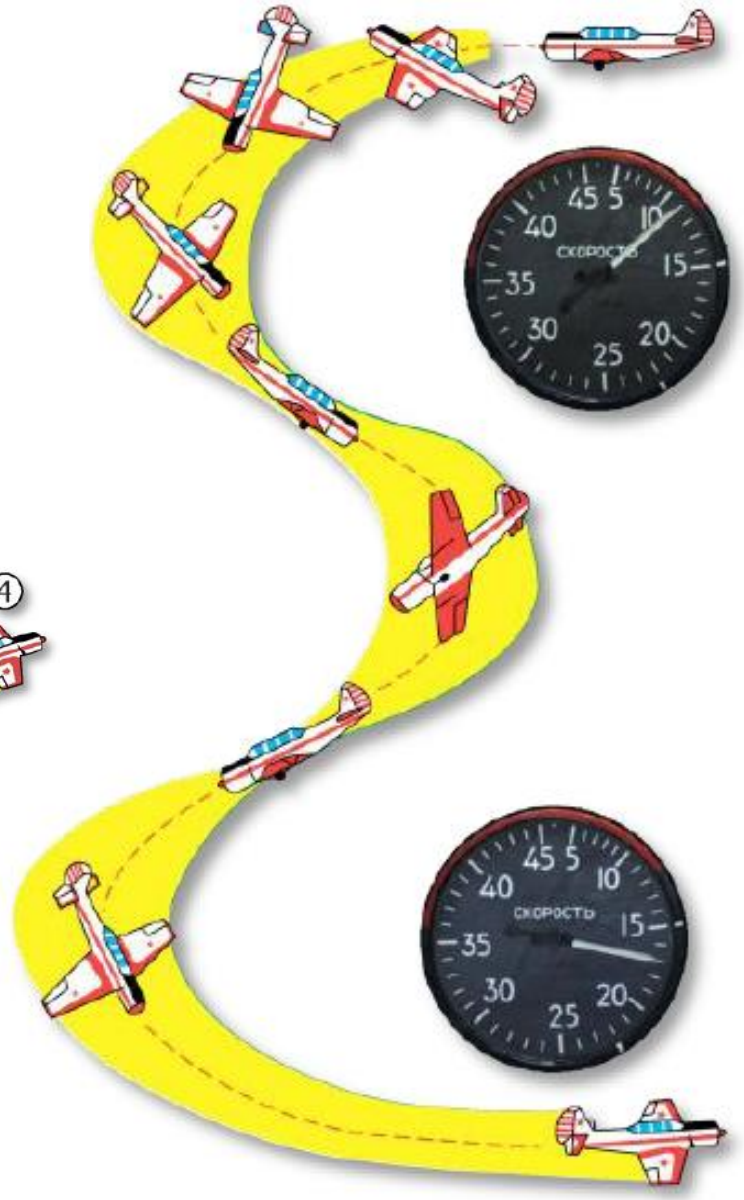
Vertical Loop (Nesterov's Loop)



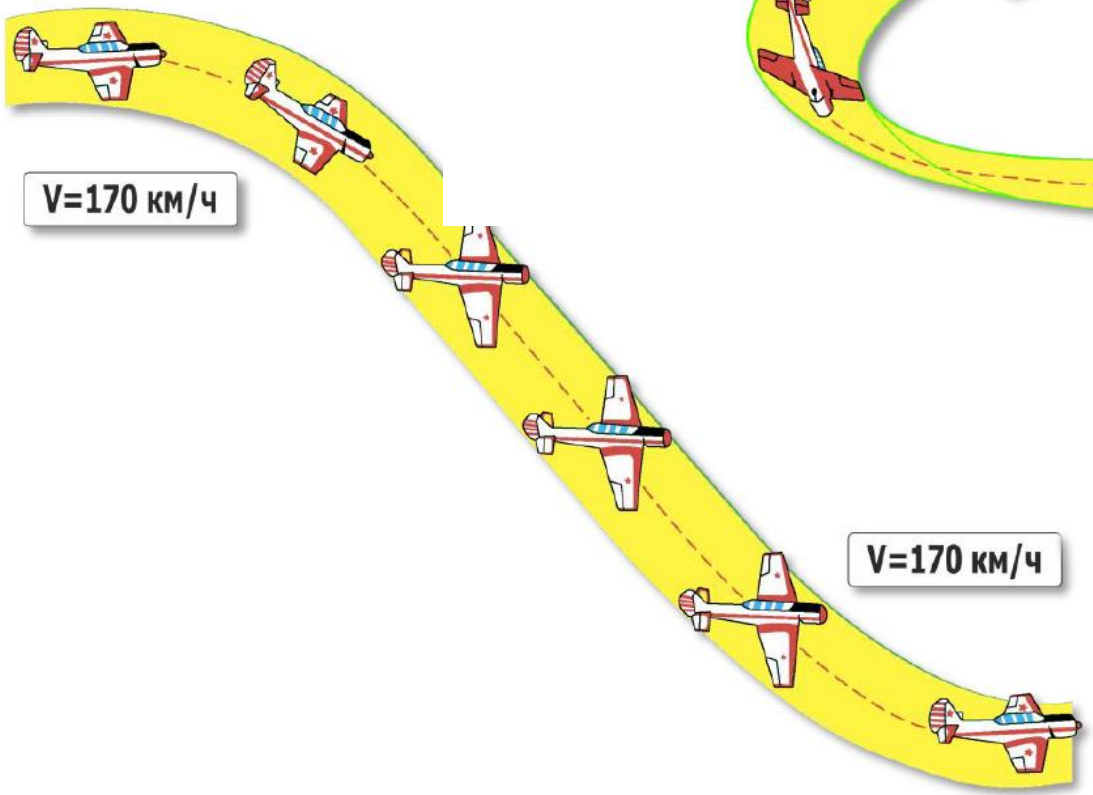
Exiting a Spiral



Tail Spin



Gliding Descent

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